NUTRITIONAL STATUS OF UNDER-FIVE CHILDREN AND ITS DETERMINANTS IN A TRIBAL COMMUNITY OF COIMBATORE DISTRICT

DISSERTATION SUBMITTED FOR

M.D. COMMUNITY MEDICINE

THE TAMILNADU DR. M.G.R. MEDICAL UNIVERSITY,CHENNAI

DEPARTMENT OF COMMUNITY MEDICINE

PSG INSTITUTE OF MEDICAL SCIENCES & RESEARCH

PEELAMEDU, COIMBATORE -641004

TAMILNADU, INDIA

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DECLARATION

I hereby declare that this dissertation entitled "Nutritional status of under-five children and its determinants in a tribal community of Coimbatore district" was prepared by me under the guidance and supervision of **Dr. Thomas V Chacko** (Guide) Professor & HOD and **Dr.K.Suvetha** (Co-guide) Associate Professor, Department of Community Medicine, PSGIMS&R, Coimbatore.

This dissertation is submitted to Tamilnadu Dr.MGR Medical University in partial fulfillment of the university regulations for the award of MD Degree in Community Medicine.

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Certificate

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This is to certify that the Dissertation work entitled "**NUTRITIONAL STATUS OF UNDER-FIVE CHILDREN AND ITS DETERMINANTS IN A TRIBAL COMMUNITY OF COIMBATORE DISTRICT"** is the bonafide work of **Dr.S.K.Senthil Kumar** done by him in the Department of Community Medicine, PSG Institute of Medical Sciences and Research, Coimbatore in partial fulfillment of the regulations for the award of the degree of M.D. Degree in Community Medicine.

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My parents and wife for making me who I am for making it all worthwhile.

LIST OF ABBREVATIONS

MDG	**M**illineum **D**evelopment **G**oals
WHO	**W**orld **H**ealth **O**rganization
NFHS	**N**ational **F**amily **H**ealth **S**urvey
IMR	**I**nfant **M**ortality **R**ate
LBW	**L**ow **B**irth **W**eight
BMI	**B**ody **M**ass **I**ndex
NCHS	**N**ational **C**entre for **H**ealth **S**tatistics
CDC	**C**entre for **D**isease **C**ontrol
NHES	**N**ational **H**ealth and **E**xamination **S**urvey
NHANES	**N**ational **H**ealth **A**nd **N**utrition **E**xamination **S**urvey
MGRS	**M**ulticentre **G**rowth **R**eference **S**tudy
ICMR	**I**ndian **C**ouncil of **M**edical **R**esearch
UNICEF	**U**nited **N**ations **I**nternational **C**hildren's **E**mergency **F**und
NNMB	**N**ational **N**utrition **M**onitoring **B**ureau
ITDA	**I**ntegrated **T**ribal **D**evelopment **A**gency
NIN	**N**ational **I**nstitute of **N**utrition
ICDS	**I**ntegrated **C**hild **D**evelopment **S**ervice
UIP	**U**niversal **I**mmunization **P**rogram
SES	**S**ocio **E**conomic **S**tatus
CPI	**C**onsumer **P**rice **I**ndex

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TITLE: NUTRITIONAL STATUS OF UNDER-FIVE CHILDREN AND ITS DETERMINANTS IN A TRIBAL COMMUNITY OF COIMBATORE DISTRICT

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BACKGROUND

Under-five children are the most at risk segment in any population and their nutritional status is a sensitive indicator of their health status and nutrition. Malnourished children are more likely to become malnourished adults and they face increased risks of morbidity and mortality. In pace with the developing countries across the world regarding socio-economic and nutritional shift, India has also undergone remarkable improvement for the last ten years but undernutrition had always remained as a notable public health problem. According to World Health Organization (WHO) and National Family Health Survey (NFHS-3), one third of all children in India suffer from low height-for-age (stunting) and nearly half of the children from low weight-for-age (underweight). One in every third child who die in this world due to causes of malnutrition are described as mildly to moderately malnourished by nutritionists and they does not show any signs of their health problem to an informal observer. Out of the 12 million preschool children who die due to any cause in developing countries each year, mortality of over 6 million are related to their poor nutritional status either directly or indirectly.

In underprivileged people like tribes these attributes are vastly prevalent. The tribal populations of India are recognized as socially as well as economically most underprivileged. Nutrition is one area in which traditional lifestyle of tribal and their lack of awareness plays a

major role. Tribal population is at a higher risk of under nutrition because of their dependence on older methods of agricultural practices and irregularity of food supply. In South India, only few tribal based studies to determine the prevalence of malnutrition among under-five children has been carried out, with paucity of data regarding prevalence of malnutrition obtained as community based study in tribal areas of Tamil Nadu. Hence this community based study was done to find out the prevalence of malnutrition and its association with selected risk factors among children aged 0-59 months in the tribal hamlets of Periyanaickenpalayam block, Coimbatore district, Tamil Nadu.

OBJECTIVES

1. To find out the prevalence of malnutrition among under-five children in a tribal community.
2. To ascertain the determinants of malnutrition among them.

METHODOLOGY

A cross- sectional study was carried among 206 children aged 0-59 months from the selected tribal hamlets of Periyanaickenpalayam block. Data was collected using Pre-tested semi structured Questionnaire by interview technique. Anthropometric measurements including weight and height were taken based on World Health Organization (WHO) standards with accuracy of 0.5 kg and 0.5cm. The 2006 WHO Growth Standards for Preschool Children was used to calculate nutritional status of the children and BMI was used to assess the nutritional status of the mothers.

The possible risk factors selected to find out their association with malnutrition are age of the child, sex of the child, number of family members, mother's education, father's education, mother's occupational status, father's occupational status, socio-economic status, alcohol usage by family members, mother's nutritional status, mother's age at pregnancy,

place of delivery of the child, term of delivery of the child, birth order of the child, birth weight of the child, time of initiation of breast-feeding, exclusive breast-feeding duration, total breast-feeding duration, energy and protein consumption of the child, immunization status, ICDS utilization by the child, distance of health facility from the house, recent illness, treatment for the illness, type of house, source of drinking water and toilet usage.

Data was entered in Microsoft excel and analyzed using Stastical Package for the Social Sciences (SPSS) 19.0 version. Mean and Standard Deviation was calculated for height and weight of children and BMI of the mothers. Possible risk factors associated with malnutrition were analyzed using univariate analysis and then multivariate logistic regression analysis done to finally identify those that were truly associated with risk of developing malnutrition.

RESULTS

Our study revealed an overall prevalence of malnutrition as 51%. These 51 %(105) malnourished children consisted of 41.3 % underweight, of which 11.2 % were severely underweight. Prevalence of stunting was 32.5 %, of which 6.3 % were severely stunted. About 21.8 % children were wasted and 6.8 % were severely wasted among them.

In our study, factors like mother's educational status, father's educational status, mother's occupational status, socio-economic status, total number of family members exceeding four, alcohol usage by any family member, mother's nutritional status, mother's age at pregnancy, place of delivery of the child, term of delivery of the child, birth weight of the child, time of initiation of breast-feeding, exclusive breast-feeding duration, total breast-feeding duration, energy and protein consumption of the child, supplementing with any other milk or milk formulas in children more than 6 months, child's immunization status, ICDS utilization by the child, recent illness and treatment for that illness, type of house, source of

Drinking water and toilet usage were found to be significantly associated with malnutrition on univariate analysis. However, when these associated risk factors were subjected to multivariate logistic regression analysis the variables which came significant were father's educational status, mother's occupational status, socio-economic status, birth weight of the child, time of initiation of breast-feeding and daily energy consumption of the child.

CONCLUSION

This study establishes the extent of problem of malnutrition coupled with problems arising due to low SES which may be a consequence of illiteracy of father and non-employment of mothers, LBW arising due to poor ante-natal history, faulty feeding practices like late initiation of breastfeeding and consumption of low calorie foods. Urgent attention to reduce the burden of malnutrition among under-five children thus preventing them from increased risk of disease morbidity and mortality in later life is needed at this hour. Most of these are known risk factors for malnutrition but the local factors influencing malnutrition should be kept in mind when planning future information education and communication programs in this area.

KEY WORDS

Nutritional status, under-five children, risk factors, tribal.

1. INTRODUCTION

The health status of the people is the wealth of a nation and nutrition is one of the most important pre-requisites for good health. Malnutrition among children in India is a well known public health problem having its impact on health because adequate nutrition is an important determinant for their good health. The nutritional status of under-five children is causing great concern among social scientists and planners nowadays because child is the principal victim of interaction of nutritional, social, economical and also health related factors that lead to malnutrition. Health related and nutrition related investments are very important forms of human assets for low income countries, including those in economically developing countries[1].

The value of future human assets is determined mainly by the investment utilized for the development of infant and young child groups. The interest arising on children's health status and their nutritional status has been defensible in many ways. In many of the developing nations, children's health from a health point of view, both in individual terms as well as in relation to the entire population is considered mainly for added resource allotment to meet enhanced child health status. To the health professional, the areas of interest in children's health as well as nutrition are equally challenging. Among the eight Millennium development goals (MDGs), three goals stress on health related goals which include reduced child mortality, improved mothers health and fighting HIV/AIDS, malaria and other diseases.[2]

Under-five children are the most at risk segment in any population and their nutritional status is a sensitive indicator of their health status and nutrition.[3] Malnutrition affects child health in an adverse manner and it is reflected in the incidence of illness among them and also their life expectancy. Malnutrition in children affects their ability to grow and the risk of morbidity and mortality is increased in their adult life. Malnourished children are more likely to become malnourished adults and they face increased risks of morbidity and mortality.[4,5] Nutritional level of any individual is determined by a large number of variables related directly or indirectly such as, occupational status, food sufficiency, their food consumption pattern, their purchasing power, circulation of funds, food distribution within houses, knowledge regarding healthy nutrition, level of education, accessibility of government health programs and knowledge, etc. There is also proof that nutrition and socio-economic development have positive correlation. Enhanced economic development leads to improved health and nutritional status, but more important is enhanced nutrition leads to improved economy.[6]

Keeping pace with other developing countries across the world regarding socio-economic and nutritional shift, India has also undergone remarkable improvement for the last ten years but under-nutrition had always remained as a notable public health problem. Among the developing countries in the world , India is one of the major countries where malnutrition among under-five children is unfavourable to their outcome of health. According to World Health

Organization (WHO) and National Family Health Survey (NFHS-3), one third of all children in India suffer from low height-for-age and nearly half of the children from underweight. Nutritional status indicators like underweight, wasting, stunting, LBW, breast feed accessibility and diseases caused by Vitamin A deficiency are still very high in India compared to other developed nations. The poor status of health of any child interferes with the normal food intake and at the same time it reduces the capacity of nutrient absorption in any child, which results in excretion of the required nutrients faster than before, which leads to further turn down in the child's health.

Unavailability of required calories in food, poor hygienic practices and lack of sanitation in the household, low Socio-economic status, poor literacy rate among parents and lack of care from health systems only exaggerate the worst situation. Since in underprivileged people like tribes these attributes are vastly prevalent, the chance of recovery from malnutrition in later stages like adolescence and adult-hood is very difficult for these underprivileged children. Child's nutritional status is certainly under the influence of urbanization, female educational status, availability of health services, safe water supply and proper sanitation.[7] It is evident that any 'summary index' of the child development indicators always keep India at the least level in this list.[8]

One in every third child who die in this world due to causes of malnutrition are described as mildly to moderately malnourished by nutritionists and they does not show any signs of their health problem to an informal

observer. Out of the 12 million preschool children who die due to any cause in developing countries each year, mortality of over 6 million are related to their poor nutritional status either directly or indirectly. Mortality among children as a result of common childhood disease is very high among malnourished children than those children who are adequately nourished. Illness is frequently a result of malnutrition and also malnutrition is frequently the result of illness.

Most of the developing countries have nowadays shown significant reduction in under-five children mortality rates over the past three decades. The survival rate of children has increased markedly nowadays and it becomes essential to pay more attention to the strong correlation between those children's nutritional status and their capability to attain the required physical growth and mental development. The effect of what happens during the prenatal period and early months and years of life can last a lifetime.[9]

Since independence, the Infant Mortality Rate (IMR) has come down to a third and the death rate has come down to a half in India. Unfortunately, undernutrition has come down only by one fifth and most of the time it is not talked about. This is the period when the production from agriculture has increased several fold and granaries are having the problem of not having enough space to store food grains[10].

Prevalence rate of malnutrition varies among different continents of the world. Nearly 70% of malnourished children live in Asian countries, 26% live in

Africa, and only 4% of children with malnutrition live in Latin America and the Caribbean.[11]

Malnutrition is undoubtedly the most serious nutritional problem affecting several thousand young children in India. Inadequate food, ignorance, undesirable social practices tend to impede child's early growth. Lack of spacing and large number of siblings are the order of the day amongst low income groups. The present study, therefore, will be undertaken to assess the prevalence of malnutrition in our area, that too among disadvantaged tribal people.

Assessment of growth thus not only serves as a method for evaluation of health and nutritional status of children, but also the quality of life of the entire population can be indirectly assessed by these indices.[12] Stunting (Low height-for-Age) is an indicator of chronic under-nutrition due to extended periods of food deprivation and/or long standing illness; Wasting (Low weight-for-height) is an indicator of acute under-nutrition, which would have resulted due to very recent food deficit and/or illness; Underweight (Low weight-for-age) is used as a composite measure which reflects both acute and chronic under-nutrition, but it cannot differentiate between them. The current WHO recommendation is to use the Z-Score or Standard Deviation (SD) system to grade undernutrition. Children who are more than 2 SD below the reference median (i.e. a Z-Score of less than-2) are considered to be undernourished i.e. to be stunted, wasted or to be underweight. Children with measurements below 3

SD (a Z-Score of less than-3) are considered to be severely undernourished. Widely recommended, the Z Scores have been widely in use in India recent days, especially in community-based studies[13]

1.1 The Global Scenario

Out of the world's 2.2 billion children, around 18,000 children die each day. Among those children who die, a disproportionate number of children are residing in per-urban areas or rural and hilly areas that are cut off from services because of geographical location or poverty. Many could be saved by little expenditure and effective methods. 24%, 25% and 8% of the world's under-five children are underweight, stunted and wasted respectively. Child malnutrition is very high in South Asia (32% percent underweight, 38% stunted and 16%wasted) than in West and Central Africa (22%underweight, 37%stunted and 11%wasted).Most undernourished countries in both these regions have similar properties in respect to economy and geographical conditions. India, Pakistan and Bangladesh are the three countries located in South Asia which accounts for about half of the world's underweight children in total. About 29 percent of the world's malnourished under-five population is residing in these countries alone. India resides about 51 million malnourished children and this count is more than Africa's 47 million malnourished children. Striking factor related to these statistics is that, only South Asia shows gender bias in the

prevalence of malnutrition of under-five children and it is seen that girls are more undernourished when compared to boys in these countries. [14]

1.2 The Indian Scenario

It is considered that health and nutrition are two sides of a coin and an important indicator of development of a country at national and world level is nutrition. When compared to India's progression in various fields, nutrition is an area where there is no significant improvement and prevalence of malnutrition is still very high in our country. Indicators of health like maternal mortality rate, infant mortality rate and under-five mortality rate are very high in India compared to many of the developing countries located in South East Asia which is the result of high poverty index and more malnutrition prevalence. The most vulnerable group in any community is the under-five children group and nearly half of the children among them do not grow to their maximum physical potential as well as in psychological aspect.

Almost 43 percent are underweight, 48 percent are stunted and 20 percent are wasted among under-five children in India. Nationwide demographic surveys and Health surveys are almost done similarly in the 41 developing countries between the years 2003 to 2007. The results of those surveys showed that prevalence underweight among child population is higher in India when compared with the other 40 developing countries. This prevalence of underweight is marginally high over our neighboring countries like Nepal and

Bangladesh. The prevalence of underweight in India is 48 percent among under-five children. Many of the socio-demographic factors of the sub-Saharan African countries are similar to India but the prevalence of malnutrition is almost half when compared to India in these 26 countries which comes around 25 percent.[15]

1.3 The Scenario in Tribal areas

Nutritional deficiencies are more prevalent among underprivileged groups. The tribal populations of India are recognized as socially as well as economically most underprivileged[16]. Nutrition is one area in which traditional lifestyle of tribal and their lack of awareness plays a major role[17]. Tribal population is at a higher risk of under nutrition because of their dependence on older methods of agricultural practices and irregularity of food supply. The basic problem of the tribal people is poverty. The problems of low standard of living, hunger, starvation, malnutrition, agricultural illiteracy, disease, poor sanitary and housing facilities, etc. are serious compared to the non-tribal population.

Scheduled Tribes are not defined in a particular way by the Constitution of India..It is referred in Article 366(25) that Scheduled Tribes are people who are scheduled in accordance with Article 342 of Indian Constitution. Article 342 of the Constitution states that Scheduled Tribes are the tribes or tribal communities or part of or groups within these tribes and tribal communities

which have been declared as such by the President through a public notification.

The essential characteristics of tribal communities are:

- Primitive Traits
- Geographical isolation
- Distinct culture
- Shy of contact with community at large
- Economically backward[18]

Tribal communities are "at risk" of under nutrition due to the above said characteristics and suboptimal utilization of health services. As per 2011 census, Approximately 635 tribal groups and subgroups including 73 primitive tribes live in India and represent about 8.6% of total population (104.3 million) of India, representing 24% of the world's indigenous peoples.[19,20]

Child born in the tribal belt is 1.5 times more likely to die before the 5th birthday than children of other groups. Children below 3 years of age in scheduled tribes are twice as likely to be malnourished than children in other groups. Infant Mortality Rates are similar across all rural population including tribes, but by age 5 Scheduled Tribe children are at much greater risk of dying.

The prevalence of Underweight, Stunting and Wasting are 55 percent, 54 percent and 28 percent respectively among under-five children of Tribal population.[15]

2. NEED FOR THE STUDY

After extensive literature search it is found that most of the Indian studies were carried out in Northern and Central parts of India. There is a paucity of data from South India regarding prevalence of malnutrition among tribal preschool children. In South India, only few tribal based studies to determine the prevalence of malnutrition among under-five children has been carried out, with paucity of data regarding prevalence of malnutrition obtained as community based study in tribal areas of Tamilnadu. Hence this community based study was done to find out the prevalence of malnutrition and its association with selected known risk factors among children aged 0-59 months in the tribal hamlets of Periyanaickenpalayam block, of Coimbatore district, Tamilnadu

Within the Periyanaickenpalayam block of Coimbatore are located the Anaikatty and Palamalai hills where we have the tribal population. These hills are an offshoot of the Eastern Ghats and they reach to merge with the Western Ghats. It lies at an altitude of 1839 m above Mean Sea Level. The tribal people here belong to Irula ethnic group with Negroid race features and are one of the six main ethnic groups of India.

These tribal people are very poor, mostly depend on wages earned from brick-kiln labor, agricultural labor and cattle rearing for their livelihood, and hence their children are at increased risk of under-nutrition.

3. OBJECTIVES

1. To find out the prevalence of malnutrition among under-five children in a tribal community.

2. To ascertain the determinants of malnutrition among them.

4. REVIEW OF LITERATURE

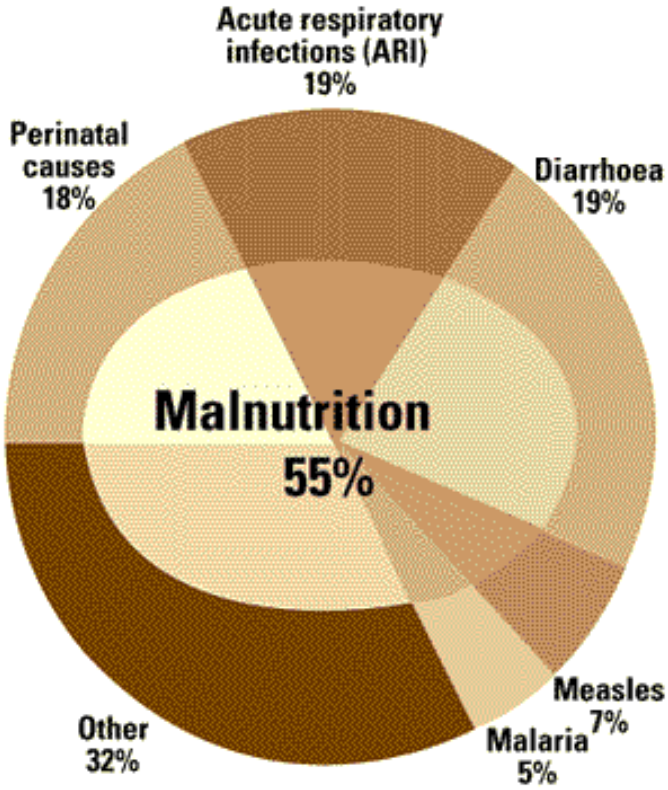
According to WHO, Malnutrition is defined as a "pathological state resulting from a relative or absolute deficiency or excess of one or more essential nutrients"[21]. Malnutrition is by far the biggest contributor to child mortality, being present in half of all cases globally. On an average, a child dies every 5 seconds as a direct or indirect result of malnutrition – 700 every hour – 16,000 each day – 6 million every year[22].

Malnutrition is frequently part of a vicious cycle that includes poverty and disease. Each of the factors in this vicious cycle is related to other in such a way that they are synergistic and they all together contribute to the overall load of malnutrition. Specific nutrition and interventions by health sectors can break the cycle, also improved health in the form of political and socio-economic changes.[23]

A range of factors like substandard food quality, inadequate intake of food and repeated occurrence of infectious diseases or in some combination of all the three factors, may lead to malnutrition in children. The above said conditions in turn are closely related to the whole standard of living and also whether a defined community can meet its essential needs, such as to nutrition, shelter and health needs. Assessment of growth not only serves as a method of evaluating the health and nutritional status of children, but also it provides an alternative method of assessment of the quality of life of the entire community.[23]

Malnutrition is looked upon as a silent emergency. But the crisis is factual, and its persistence has deep and alarming implications for children, society and humankind in the future. And malnutrition is not only a silent emergency but it is also largely not visible to everyone. According to nutritionists, of about seventy five percent of the children dying worldwide, the causes related to malnutrition and they are only mildly to moderately malnourished and do not display any outward signs of malnutrition to a casual observer. Death due to common childhood illness is more common in a malnourished child when compared with an adequately nourished child. Illness is often a consequence of under nutrition and under nutrition is also commonly the result of illness. Even in mildly underweight children, the risk of mortality is very much increased.[24]

Fig.1 Malnutrition and Child Mortality



Source: WHO.[25]

Malnutrition is like an iceberg; the problem of malnutrition is more among people of developing countries than what we see from outside. Malnutrition makes the child more susceptible to infection, recovery is slower and mortality is higher. It comprises of 4 forms,

- Undernutrition.
- Overnutrition.
- Imbalance.
- Specific deficiency.

4.1 Methods employed in Nutritional Assessment are[26]

A. Direct Methods

Clinical Examination

Anthropometric measurements

Biochemical evaluation

Functional assessment

Assessment of Dietary Intake

B. Indirect Methods

Vital statistics

Assessment of Ecological factors

4.1.1 Clinical Examination

Clinical examination is an essential feature of all surveys since their ultimate objective is to assess levels of health of individuals or population groups in relation to the food they consume. It is also the simplest and the most practical method of ascertaining the nutritional status of a group of individuals. There are a number of physical signs, some specific and many non specific, known to be associated with states of malnutrition. When two or more clinical signs characteristic of deficiency disease are present simultaneously, their diagnostic significance is greatly enhanced[27]. A WHO Expert Committee on Medical Assessment of Nutritional Status classified signs used in the nutritional surveys in to three groups[21].

Group 1. Signs that are considered to be of value in nutritional assessment, they indicate with considerable probability deficiency of one or more nutrients in the tissues in the recent past. **Eg:** angular stomatitis, Bitot's spots, calf tenderness, absence of knee or ankle jerks (beri-beri), enlargement of thyroid gland (endemic goiter) etc.

Group 2. Signs that need further investigations, but in whose causation malnutrition, sometimes of chronic nature, may play some part together with other factors. They are found more commonly in people with low standards of living than among more privileged groups. **Eg**: malar pigmentation, corneal vascularisation, geographic tongue.

Group 3. Signs not related to malnutrition, according to present knowledge, but which, in some instances, have to be differentiated from signs of known nutritional value. Eg: alopecia, pyorrhea, pterigium

Clinical signs have the following drawbacks:

a) Malnutrition cannot be quantified on the basis of clinical signs.
b) Many deficiency signs are unaccompanied by physical signs.
c) Lack of specificity and subjective nature of most of the physical signs

4.1.2 Anthropometric measurements

The body measurements commonly employed in anthropometry are weight, height, head circumference, chest circumference, abdominal circumference, skin fold thickness etc. Anthropometry is the single most portable, universally applicable, inexpensive and noninvasive method available to assess the proportion size and composition of the human body. It is a simple valuable tool and the gold standard for evaluating the nutritional status. Adequate precautions to be taken during measurements and the procedures utilized to be standardized.[28]

The anthropometric measurements used in this study are.

1) Weight(Wt)
2) Height(Ht)
3) Body Mass Index(BMI)

Weight, height and BMI for age are parameters for assessment of nutritional status in children. Of these, weight for age is the most widely used indicator for assessment of nutritional status because of ease of measurement.[29]

4.2 GROWTH STANDARDS

4.2.1 The WHO Growth References and Standards

Since the 1970s the WHO has made available several versions of growth references which are recommended for international use to help evaluate children's growth and nutritional status. Since then, there are three commonly known and used versions:

- The 1978 WHO/ National Centre for Health Statistics (NCHS) Growth References which is used for children up to the age of 10 years
- The WHO Growth References which is used for children and adolescents who are aged up to 19 years
- The 2006 WHO Growth Standards which is used for preschool children aged up to 6 years of age from birth

The earlier versions on growth references were mostly based on US children and were used by them. The United States Centre for Disease Control (CDC) National Centre for Health Statistics (NCHS) formulated growth references based on survey data which was collected nationally in the 60s and 70s. The Growth Charts developed by CDC NCHS included anthropometric measurements such as, weight-for-age, height-for-age, weight-for-height and head circumference-for-age. Many national level surveys like National Health Examination Surveys (NHES II, NHES III) and National Health and Nutrition

Examination Survey (NHANES I) helped them develop these Growth Charts and also a local study for infants named the Fels Longitudinal Study.[30]

4.2.2 The 2006 WHO Growth Standards for Preschool Children

The new growth standards for children aged 0 – 60 months (5 rears) was released by WHO on April 27, 2006. In order to create growth standards for different races/ethnicities, the Multicentre Growth Reference Study (MGRS) recruited prosperous, breast-fed, and healthy infants/children whose mothers were not smokers during or after delivery involving six cities in Brazil, Ghana, India, Norway, Oman and the USA.

The study was done on a longitudinal sample followed from birth to twenty four month-old and a cross-sectional sample recruiting eighteen to seventy one month-old children. The MGRS study showed uniform pattern in growth across the world in all the study centers, there was only 3% of variation observed among all the children in growth contributed by different race or country. The multicenter data were collective for a very dominant sample hence. When the health care and nutrition needs were met adequately, the under-sex children in different parts of the world were able to attain almost similar levels of weights and heights according to the collected data. However, these results were based on children aged 0 – 72 months spread over the six cities. Variations in height among various individuals due to genetic influence could not be ruled out from these study subjects. The new standards of growth charts were

recommended by WHO all over the world in place of the old standards. Some of the countries still follow their own growth standards or growth references.

Anthropometric indicators like length/height-for-age, weight-for-age, weight-for-length/height, BMI-for-age, head circumference-for-age, arm circumference-for-age, sub scapular skin fold-for-age, and triceps skin fold-for-age were included in the 2006 Growth Standards. In children aged 0-24 months recumbent length-for-age was used as an indicator of stature and in children aged 2-5 years standing height-for-age was used as an indicator. Due to degree of difference in measurements of height/length, a 0.7 cm taller in length at the age of 24-months was observed. Weight-for-length for 0-24 month old children and weight-for-height for 25-60 months old children were represented in different charts to address this issue. The growth charts for various indicators involving stature showed a disjunction between the curves for 0-2 years old and those for 2-5 years old.

The growth charts and tables of percentiles and Z-scores are presently separately for boys and girls by WHO. The curves for 0, ±2, and ±3 SD from the age specific median of certain indicator were plotted on the Z-score charts. Five curves for the 3^{rd}, 15^{th}, 50^{th}, 85^{th}, and 97^{th} percentiles were plotted for each indicator as for the percentile charts. The values of indicator at 0, ±2 and ±3, and for percentiles of 1^{st}, 3^{rd}, 5^{th}, 15^{th}, 25^{th}, 50^{th}, 75^{th}, 85^{th}, 97^{th}, and 99^{th} were given for each age of month in these tables. There are many differences between

the new 2006 WHO standards and the old growth charts. The new 2006 standards show “how children should grow” and it is is developed using a regulatory approach, not by just a vivid approach. Every child in this world can attain equal levels of normal weight and height as long as they are given the nutrition and care for health adequate for their age.

The main feature of these 2006 growth standards is that it assumed breast feeding as a biological norm. Unlikely to previous WHO growth standards, the pooled sample in this study is collected from six participating countries and not from a single country so that better standards could be mainted. An advantage of these standards is that both obesity and under-nutrition could be detected using this tool. The standards go beyond the previous references and include An advantage of these growth references compared to previous references is that indicators like skin-fold thickness and BMI are included in these references. Obesity is an important public problem in both developing and developed countries and these charts are very helpful in monitoring obesity.[30]

Community standards for anthropometric measurements are difficult to define because the kind of population differs from one place to other and also on race and genetic background. Standards for a community are usually obtained by measuring a statistically adequate sample of healthy; well fed segment of population, whose ages are known with certainty.[31]

Previously NCHS, CDC, and Indian Council of Medical Research (ICMR) standards were used for growth assessment. In the present study standards of WHO conducted Multicentre Growth Reference Study (MGRS) are used which was published in 2006. The MGRS was a community based, multi-country project conducted in Brazil, Ghana, India, Norway, Oman and United States. The children involved in this study are grown in a background which minimizes the chances for malnutrition such as poor nutrition and illness.[31]

4.3.1 Weight

This "key" anthropometric measurement "Weight for age" helps in assessing the current nutritional status and also helps in monitoring growth in children when recorded and plotted in "Road to Health" card. Weight is affected first than all parameters in protein energy malnutrition.

The current weight in (in kgs) of the children is compared with the expected standard weight and deficiency in percentage is expressed in terms of degrees of malnutrition.[32]

4.3.2 Height

Height is a measure of skeletal elongation. "Height for age" gives an indication of duration of malnutrition. Low height for age is also known as nutritional stunting or dwarfing. It reflects past and chronic malnutrition.[32]

4.3.3 Mid arm circumference (MAC)

The arm circumference remains fairly constant between I to 5 years of age from 16.5 to 17.5 cms. It is one of the age dependent anthropometric indicators. Measurement is performed in the left arm, midway between the acromian and the olecranon. The measurement tape is held gently without pressing the soft tissues.[32] MAC is useful method of screening large number of children during nutritional emergencies. MAC is not useful in continuous growth monitoring as it increases very slowly in the age group of 1to5 years.[28]

4.3.4 Head circumference

At birth the head circumference is 35cms, it increases 40cms by 3months, 43cms by 6months, 47cms by 1year, 49cms by 2years, and 50cms by 3years. The approximate increase is 2cm per month in the first 3months, 1cm per month in the next 3months, 0.5cm per month in the next 6months.

4.4 WHO system of Classification

Z-score < -1 to > -2: Mild Malnutrition

Z-score < -2 to > -3: Moderate Malnutrition

Z-score < -3 : Severe Malnutrition

4.5 Prevalence of malnutrition

4.5.1 Global perspective

Prevalence of Malnutrition among children under 5 years of age in developing countries, 2014[14]

Region	Stunting %	Underweight %	Wasting %
1.Sub-Saharan Africa	28	38	9
2.Middle East and North Africa	7	18	8
3.South Asia	47	38	16
4.East Asia and Pacific	9	12	4
5.Latin America and Caribbean	3	11	1
6.CEE/CIS	2	11	1

where, **CEE - Central and Eastern Europe**

CIS - Commonwealth of Independent States

Agencies like WHO, World Bank and United Nations International Children's Emergency Fund (UNICEF) have worked in the process of collecting and comparing the anthropometric data which is used to compute and inference the under-five children's nutritional status for their averages and trends globally.

M. de Onis et al in a model named 'Methodology for Estimating Regional and Global Trends of Child Malnutrition' has arrived at the global and local averages for both severe and moderate overweight, underweight, wasting and stunting as a part of this course. According these agencies 24%, 25% and 8% of the world's under-five children are underweight, stunted and wasted respectively with South Asian countries leading in statistics (32% percent underweight, 38% stunted and 16%wasted)[14]. One study by **Salehi M et al** documented that 49% of children below 5 years old are malnourished in southern parts of Iran where Qashqa'I, Turkish-speaking ethnic nomadic pastoralist tribal people live.[33]

4.5.2 Indian Perspective

The nutritional status of children 1-5 years of age showed significant differences among tribes of various states. The prevalence of underweight varied from 13 percent in the state of Meghalaya to 77 percent in Gujarat. According to the WHO, it is a serious problem if the prevalence of underweight is above 30 percent in public health point of view. The prevalence of stunting is in the range of 20percent in the state of Goa to 83percent in Gujarat. The prevalence of stunting is more than 40percent in many states and it is considered a serious public health problem in view of WHO. Also according to WHO, prevalence of wasting more than 15percent is considered as serious public health problem and in many states of our country it is more than 15 percent in

the same way as that of stunting and underweight. The prevalence of wasting is highest in the state of Arunachal Pradesh (32%) and it is lowest in the state of Manipur (28%) according to various studies.[34]

The trends in prevalence of malnutrition shows a decline of underweight from 78.6% to 47.0%; stunting from 78.6% to 45.5% and wasting from 18.1% to 15.5%, according to National Nutrition Monitoring Bureau **(NNMB)** study in 1975-79 and National Family Health Survey (**NFHS II)** study in 1998-99 respectively. In spite of these impressive developments on record, more than half of young children continue to suffer from moderate and severe malnutrition and therefore still much needs to be done. Malnutrition is thus widespread in rural, tribal and urban slum areas and is a significant health problem described as silent emergency and invisible enemy affecting those who cannot express their voice and have to depend upon others for advocacy. Further there are severe variations in prevalence of malnutrition in different regions, states and segments of the country.[35]

The study conducted by Indian Council of Medical Research **(ICMR)** as a part of Research among Tribals in the city of Jabalpur, India it is found that the prevalence of underweight is 61.6% among preschool children, stunting is 51.6% and wasting is 32.9%. The study also reported that severe degree of underweight, stunting and wasting (below -3 SD) is 27.8%, 30.3% and 6.5% among tribal under-five children respectively. This was similar in both sexes.[36]

Prevalence of under nutrition among children aged up to 5 years showed that 17 out of 20 (85percent) children suffered from mild to moderate degree of under nutrition while 2 out of 20 (10percent) suffered from severe under nutrition and the results showed that totally 95 percent of under-five children are suffering from malnutrition according to a study conducted among the Onge tribe of the Andaman and Nicobar Islands by **Roa V G et al**. The results of this study proved that under nutrition among children has been in existence for a very long time among tribal people of Andaman Nicobar Islands and this may be due to their physical remoteness and smaller numbers.[37]

A community based cross-sectional study was carried out in ITDA (Integrated Tribal Development Agency) Areas in nine States of India (Andhra Pradesh, Gujarat, Kerala, Karnataka, Maharashtra, Madhya Pradesh, Orissa, Tamil Nadu and West Bengal) during 2007-08 by National Institute of Nutrition, Indian Council of Medical Research, Hyderabad, India and reported by **Meshram et al**. A total of 14,587 children were covered and it was found that the overall prevalence of underweight was about 49%, of which 19% were severely underweight. The extent of overall stunting was about 51%, and of them, about 24% were severely stunted. About 22% of children had wasting, of which 7% had severe wasting.[38]

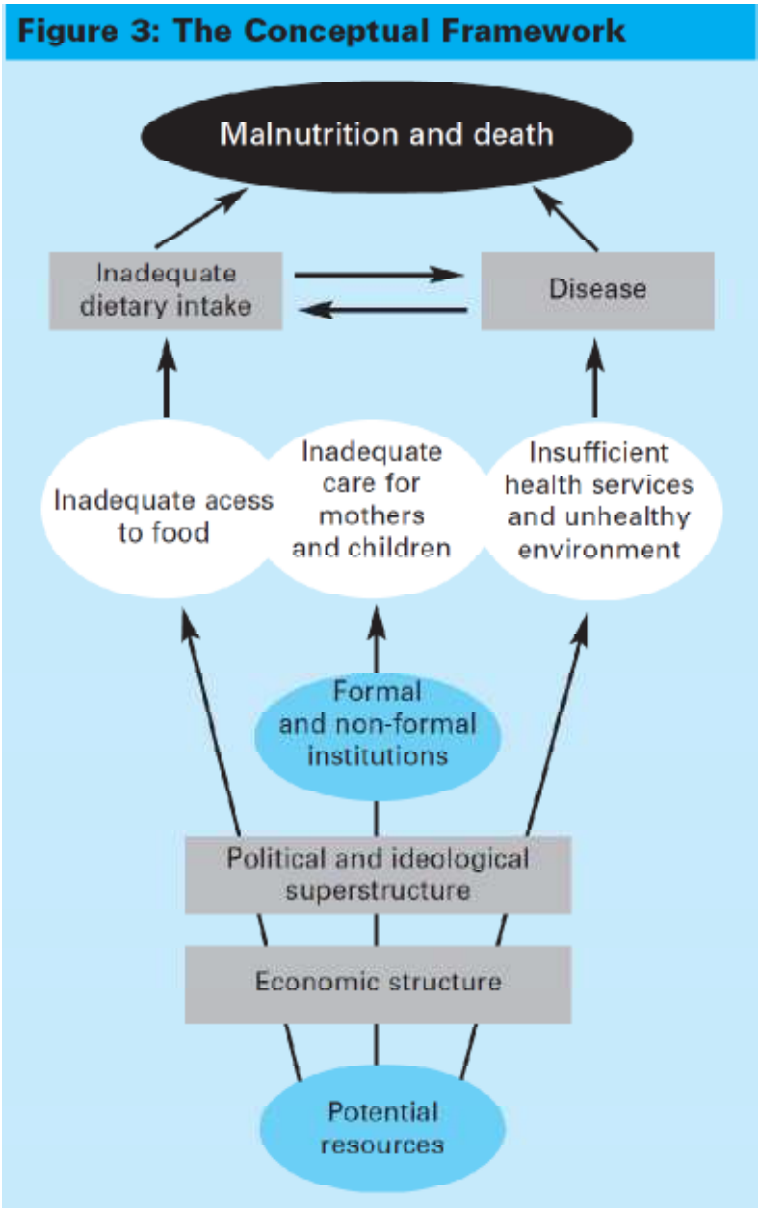
Meshram et al also in an another article reported under five children's nutritional status in the state of Maharashtra among 1751 children and has revealed the prevalence of underweight, stunting and wasting as 64%, 61% and 29%, respectively which was higher when compared with national statistics.[39]

4.6 Factors contributing to malnutrition

The United Nations Children's Emergency Fund (UNICEF) conceptual framework of child malnutrition model shows various levels for prevention and management which can lead to reduction in morbidity and mortality rates which are caused by malnutrition. The factors causing malnutrition must be thoroughly evaluated in order to prevent or manage malnutrition. The causes of malnutrition may be immediate causes, underlying causes and basic causes. All of those above mentioned causes may be interrelated to each other according to UNICEF.[40] All factors go hand in hand with each other and not independently.

Fig 2.UNICEF conceptual framework of the causes of malnutrition

(UNICEF 2003)[40]



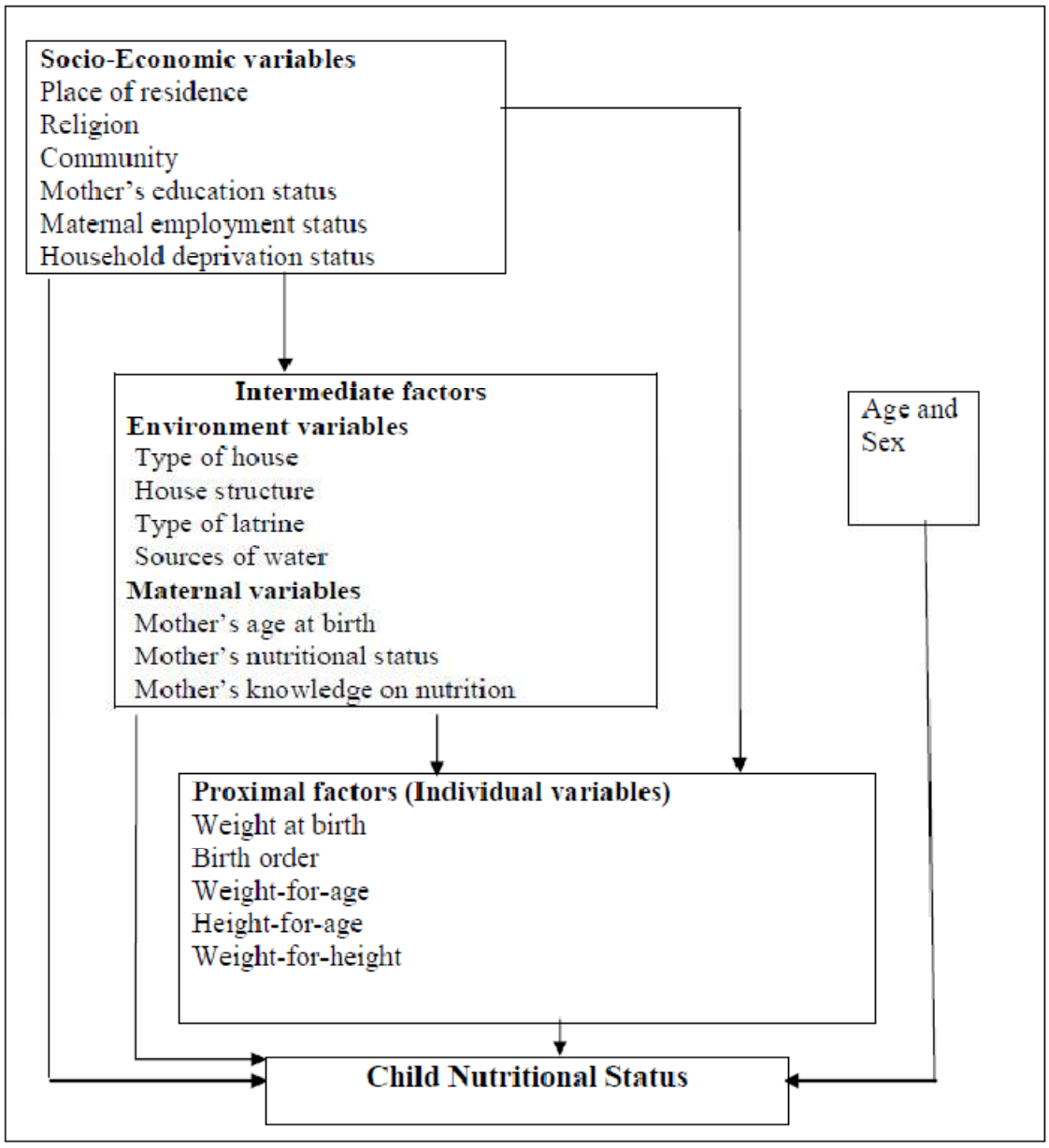
The conceptual framework model by UNICEF shows that inadequate food intake and illness of a child are the immediately associated with under-nutrition. Food security, health services, care of women and children and environment are the underlying causes of malnutrition. Most of the nutrition programmes conducted all over the world have targeted on expressing the underlying causes of malnutrition in young children by means of fruitful interventions like home gardening, food subsidies, breastfeeding counseling among mothers, health education on nutrition, supplementation of iron and vitamin A, fortification of salt with iodine, universal immunization, clean and safe water and enhanced sanitary facilities, and growth monitoring and promotion. All of the above mentioned interventions relied on the factors which were mentioned in the above conceptual model.

Most of the factors related to undernutrition in the above conceptual framework guide us through interventions targeted at improving child and women nutritional health which could be followed in the post-natal period. It does not sufficiently reproduce the additional aspect of intergenerational causality: short, undernourished women give birth to low birth weight babies. These low birth weight babies tend to grow up as short adolescents and women in the future. Thus interventions must target worldwide causes of child undernutrition and look forward to increase resources such as food, care, health services, clean water, etc. which are essential for favorable growth and proper

nutrition. These interventions must be complemented with interventions that deal with the nutrition and health of women during ante-natal and peri-natal period. These measures would check adolescent pregnancies and that subsequently on the decrease in low birth weight and stunting as immediate and also as long-standing ways to decrease undernutrition.[40]

Causes of malnutrition in children range from social and biological to environmental factors and they are inter-related with each other in a complex manner .[41] To deal with these risk factors of undernutrition in children which are multifaceted, hierarchical and inter-related with each other, particularly in less developed and developing countries, **Victoria et al** have projected the use of frameworks and models which are used for studying and predicting the risk factors of health outcomes.[42] Based on various researches regarding the causes of undernutrition they constructed a conceptual hierarchical framework of the risk factors of undernutrition. Various factors in this framework can be divided into three groups: socio-economic factors like place of residence, religion, community, education status of mother, mother's occupational status, household deprivation status etc, intermediate variables include environment factors like type of house, structure of house, latrine type, drinking water source etc, and maternal factors like mother's age at birth, nutritional status of mother, knowledge on nutrition among mothers, and proximal factors discussed here are birth weight, birth order, underweight, stunting and wasting.

Fig.3 Conceptual Framework by Victoria et al[42]



According to the conceptual framework, socioeconomic factors may influence directly or indirectly, the other determinants of malnutrition with the omission of sex and age. These include environmental factors such as house

type, structure of the house, latrine type, sources of drinking water, maternal factors such as mother's age at birth, nutritional status of mother, knowledge on nutrition among mothers, food habits among communities and their respective beliefs and immediate factors such as birth weight, birth order, time of initiation of breast-feeding and exclusive breast feeding duration, underweight, stunting and wasting. These factors, in turn, may affect the nutritional status of under-five children.[43]

4.6.1 Age of the child

A community based cross-sectional study was carried out in ITDA areas in nine States of India during 2007-08 by NIN, ICMR, Hyderabad and analyzed by **Meshram et al**. A total of 14,587 children were covered and it was found that the odd's ratio of an under-five child becoming underweight and stunted was increased by 1.89, and 2.53times respectively in the age group of 1-3 years compared to 0-1 year child. The odd's ratio for the same was 1.94 and 2.04 in the age group of 3-5 years compared to 0-1 year.[38]

Bisai S et al, in a study conducted among Lodha tribal children in West Bengal has reported that odd's ratio of a child being underweight and stunted is increased by 2.05 and 1.88 times in early childhood (1-3 yrs) when compared to late childhood (3-6yrs).[44]

4.6.2 Gender of the child

Meshram et al also has concluded that male under-five child is 1.17, 1.23, and 1.19 times more prone for underweight, stunting and wasting respectively when compared to girl child. This study was done in nine states of India among tribal population.[38]

He had also reported an increased risk of 1.31, 1.30, and 1.42 times for underweight, stunting and wasting respectively in boys when compared with girls, in a study conducted in Maharashtra.[39]

4.6.3 Birth order of the child

Children of higher birth orders are much more likely to be underweight than children of lower birth orders. The proportion of children who are underweight are 36 percent for first-order, 41 percent for the birth order of 2-3, 50 percent for the birth order of 4-5 and 57 percent for sixth and higher order births, according to **NHFS-3**.[8]

4.6.4 Birth weight of the child

NFHS-3 reveals that children with a low birth weight (<2.5 kg) are much more likely than other children (≥2.5 kg) to be malnourished as they grow up. The percentage of under-five children who are underweight, stunted, and wasted are 46 percent, 47 percent, and 23 percent respectively in LBW children and 30 percent, 36 percent, and 16 percent in normal children.[8]

The prevalence of Underweight status among under-five children are 47 percent in LBW (<2.5 kg) babies, 36 percent in babies with 2.5-3 kg birth weight and 26 percent in babies with ≥3 kg birth weight and is determined by a number of factors, but important among them is maternal nutrition. Malnourished or low-weight mothers are more likely to give birth to low-weight babies according to **Deolalikar** in article in World Bank 2005.[45]

4.6.5 Total family members

The risk of Underweight and Wasting was found to be 1.28 and 1.29 times increased in under five children born in family with >4 members when compared to small family with ≤4 members according to the national level study by **NIN**, Hyderabad.[38]

According to **Mekonnen H et al**, the risk for underweight status in under-five children is 2.35times in families with ≥5 members when compared to family with lesser members in a study done in North West Ethiopia.[46]

4.6.6 Mother's education

Maternal education has a strong inverse relationship with all three measures of nutritional status according to **NFHS-3**. The percentage of children who are underweight is almost three times as high for children whose mothers have no education than for children whose mothers have completed at least 12

years of education (52 percent vs 18 percent). The educational differentials are almost as large for stunting too (57 percent vs 22 percent).[8]

The risk of Underweight, Stunting and Wasting among under-five children living with illiterate mothers is 1.85, 1.68, and 1.38 times when compared to under-five children living with literate mothers in the nationwide study by NIN, Hyderabad, reported by **Meshram et al**.[38]

4.6.7 Father's education

The risk of Underweight, Stunting and Wasting among under-five children living with illiterate fathers is 1.51, 1.41 and 1.19 times when compared to under-five children living with literate fathers according the same study by National Institute of Nutrition **(NIN),** Hyderabad.[38]

Under-five children of illiterate fathers have a risk of 1.33 times for malnutrition when compared with children of literate fathers according to a Bangladesh study by **Islam et al**.[47]

4.6.8 Mother's occupation

The prevalence of underweight children was higher (21.2%) in housewife mothers than those mothers who are engaged in agricultural and allied activities (13%) according to **Chandran V K P**, in a study conducted in Kazhargode district, Kerala.[43]

In a study conducted in Ethiopia by **Girma W et al**, there is a marginal increase in stunting in under-five children of employed mothers when compared with under-five children of unemployed mothers (50.6 vs 48.2).[48]

4.6.9 Father's occupation

Under-five children of labour class (58.99%) are more malnourished when compared to children of professionals (7.86) according to a study by **Farooq A**, conducted in Srinagar, India involving 807children.[49]

In a study done by **Islam et al** in Bangladesh, he has utilized the data of 4460 children from a nationwide survey and has reported that the risk for malnutrition is increased by 1.48 times in under-five children of farmers when compared to children of business people.[47]

4.6.10 Mother's nutritional status

The nutritional status of children is strongly related to the nutritional status of their mothers. The prevalence of underweight in under-five children of mothers who are obese/overweight, normal and underweight are 20%, 39% and 52% respectively according to **NFHS-3** data.[8]

In a study done on a large sample of 5419 under-five children in Bangladesh, **Rayhan M I et al** has reported that the risk for underweight is increased by 38 percent in children of malnourished mothers when compared to children of nourished mothers.[50]

4.6.11 Socio-economic status (SES)

There is a strong inverse relationship between undernutrition in children and the socio-economic status of the family. Six out of 10 children living in low Socio-economic status are stunted and almost as many are underweight whereas, one-quarter of children are stunted and one-fifth are underweight in high socio-economic status children according to **NFHS-3** data.[8]

Nutritional grade with economic status was found to be highly significant according to **Harishankar et al** in a study done in Eastern Uttar Pradesh. He found that 35.6 percent of under-five children were malnourished in low socio-economic group compared to 13.5 percent in high socio-economic group.[51]

4.6.12 Alcohol consumption by any family member

Saina J, in a study done in Nairobi, Kenya involving 170 households has reported that a high percentage (38.1%) of children from alcohol consuming households were underweight, compared to children from non-alcohol consuming households (14.3%).

4.6.13 Household characteristics

Yadav R J et al in their study, concluded that severe and moderate levels of malnutrition was much higher among those with poor housing conditions even with the same level of dietary intake, whereas in spite of lower

dietary intake , the level of malnutrition was significantly lower among those living in a pucca house.[52]

The children who drink piped water and safe tube well water are nearly 21% and 29% less likely to experience malnutrition than the children drinking other sources of water (such as dug well water, unprotected well, surface water, unprotected spring, river or dam or lake or ponds or canal, rain water, etc) according to **Islam M** et al in a study conducted in Bangladesh. He has also revealed that toilet facility is strongly associated with malnutrition status of children. A child from a family having no sanitary toilet facility has 1.43 times higher risk of experiencing malnutrition than a child with toilet facility.[47]

Nutritional status of children, nutritional deficiencies are most prevalent in households that obtain their drinking water from wells, tube wells, and surface water (48% underweight) and less prevalent in households that use piped water supply (42% underweight). Also according to **NFHS-3** data, young children in households that use improved toilet facilities are much less likely than other children to be stunted, wasted, and underweight. For example, almost half of children in households without improved toilet facilities/open air defecation are underweight, compared with only 28 percent of children in households with improved toilet facilities. More than half of children in households without improved toilet facilities are stunted compared with 34 percent in households with improved toilet facilities/open air defecation.[8]

4.6.14 Mother's age at child birth

According to **Sonowal C J**, in a study conducted in Maharashtra, percentage distribution of malnourished children within the age groups of mothers also shows that maximum numbers of mothers in the early age group have malnourished children. As age increases the percentage of malnourished children also decreases. He has reported high prevalence of malnourishment in children delivered by mothers before 20 yrs (>12%) when compared to children delivered after 20 years (<8%).[34]

4.6.15 Place of child birth

The Home delivery children had 13 times greater risk to be underweight, 5 times greater risk to be stunted and 6 times greater risk to be wasted than their Institutional delivery counterparts, according to a community based study by **Biswas S** et al in West Bengal.[53]

4.6.16 Infant and young child feeding practices

An important correlate of child nutritional status is nutrient intake, which in turn depends on the nature and duration of feeding (including breastfeeding) practices. Feeding practices are especially critical during the first few days and months of an infant's life, since growth is faster and protection against illnesses and infections is most needed during this crucial period. Ideally, a baby should be put to the mother's breast immediately after birth.[45] The Government of India recommends that breastfeeding should begin immediately after childbirth,

preferably within one hour of delivery. Overall, only one quarter of children are breastfed within the first hour of birth and slightly more than half are breastfed within one day of birth in India. It is important to breastfeed the child right after birth because the first breast milk (called colostrum) is highly nutritious and contains antibodies that help protect the newborn child from diseases which may lead to malnutrition.[15]

Hien NN et al found that duration of exclusive breast feeding < 6 months as a significant risk factor to underweight (OR = 4.41) and stunting (OR = 3.58) and time of initiation of breast feeds more than 1 hour was significantly related to underweight (OR = 2.54).[54]

Majlesi F et al in their study in rural Khorambad Province found that breast feeding for more duration decreases the risk for malnutrition. 10.5 percent of children breast fed for ≤ 1 year were underweight whereas only 4.5 percent of the children breast fed for 1-2 years were underweight as reported by them.[55]

Mahgoub et al in their study in Botswana revealed that, prevalence of malnutrition was 40 percent among children who never breast fed their children whereas it is was 14.7 percent among the children who breast fed their children after birth.[56]

The obvious fact that "we are what we eat" has been formally confirmed in a lot of studies relating dietary intake to the child's nutritional status. **Mishra et al** in their study of 520 under-five children of Varanasi show that 90% of the malnourished children were consuming < 50% of the RDA of calories. [57]

Arya A et al in their study among 200 mothers show that food consumption pattern was better in children with literate mothers as compared to children of illiterate mothers and the consumption milk and milk products, and food with high calorific value was significantly greater in children with literate mothers.[58]

4.6.17 Precedent illness

Illness and infection, especially diarrheal infections, are strongly associated with child malnutrition. Infections reduce the ability of the body to absorb critical nutrients from food, which in turn leads to malnutrition.

Meshram et al in his study done in under five children of Maharashtra has revealed the risk of underweight is 1.72 times if the child suffered from ARI, risk of wasting is 2.83 times if the child suffered from diarrhea, and risk of wasting is 2.19 times if the child suffered from fever in the last fortnight.[38]

Mekonnen H et al in a study done among under five children in Northwest Ethiopia has reported that children who had suffered any illness in the past fortnight is 4.38 times to be malnourished when compared to children who did not suffer.[46]

4.6.18 Immunization status

Mekonnen H et al has also reported that under five children who were immunized appropriate for age in Fogera District, Northwest Ethiopia are protected by 35 percent against underweight when compared to children who are not appropriately immunized for age, and also unvaccinated children were more likely to be wasted.[46]

According to **Devi P Y et al** in a study done among under five children in Andhra Pradesh there was significant association between Underweight status and unimmunized child.[59]

4.6.19 I*ntegrated Child Development Service* (ICDS) utilization

Deshmuk P R et al studied the prevalence of underweight children in Maharashtra. A cross-sectional survey was undertaken in Anganwadi areas of 20 villages. Out of the 1491 under-five children studied, prevalence of underweight was similar among beneficiaries and non-beneficiaries of ICDS according to their study. The boys were more underweight (49.0%) than girls (46%) by WHO standards.[60]

A study was conducted by **Geoge KA et al** among 3633 pre-school children of 108 selected Anganwadi areas in rural areas of Kerala. The study showed that prevalence of malnutrition was 53.3 percent among those children which was comparable with the national prevalence and there is no significant difference between ICDS and non-ICDS groups.[61]

Badani K D et al studying the nutritional status of 3157 children attending ICDS centers in Vadodara and comparing the nutritional status of ICDS beneficiaries and non-beneficiaries have concluded that there is no significant difference in the children's nutritional status due to the ICDS program.

5. METHODOLOGY

5.1 Study Population

The objective of this study was to find out the prevalence of malnutrition among under-five children in a tribal community and to ascertain the determinants of malnutrition among them. Anaikatty and Palamalai hills are located in Perianaikenpalayam block (population=347062) of Coimbatore district, Tamil Nadu. These hills are offshoot of the Eastern Ghats geographically contiguous with the Billigriranga hills range as they reach out to merge with the Western Ghats. It lies at an altitude of 1839 m above mean sea level and an altitude of 1400 m on the Western Ghats. The tribal people here belong to Irulars. Irulars are small tribal community within the Dravidian language group which is spoken in South Eastern India. They belong to the Negrito (or Negroid) race which is one of the six main ethnic groups that add to the racial mosaic of India. The population of Irula tribes is 4220(1.6% of the block population) and under-five population among these tribes is 219. All the under-five children were included in this study.

Fig.4 Map showing the Administrative blocks in Coimbatore

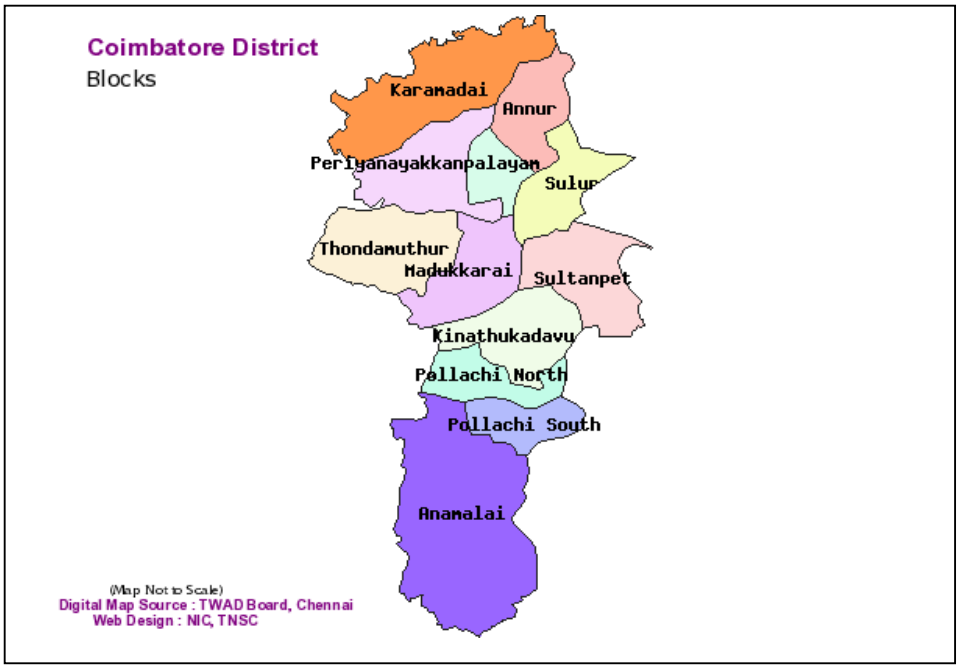
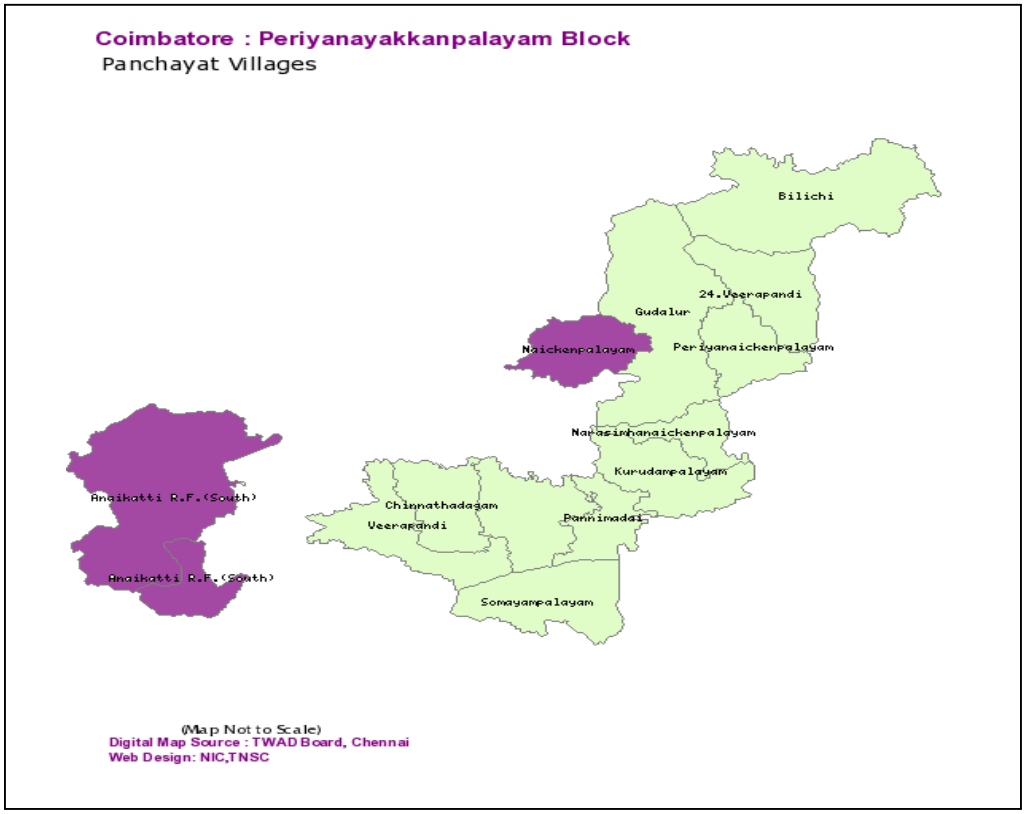
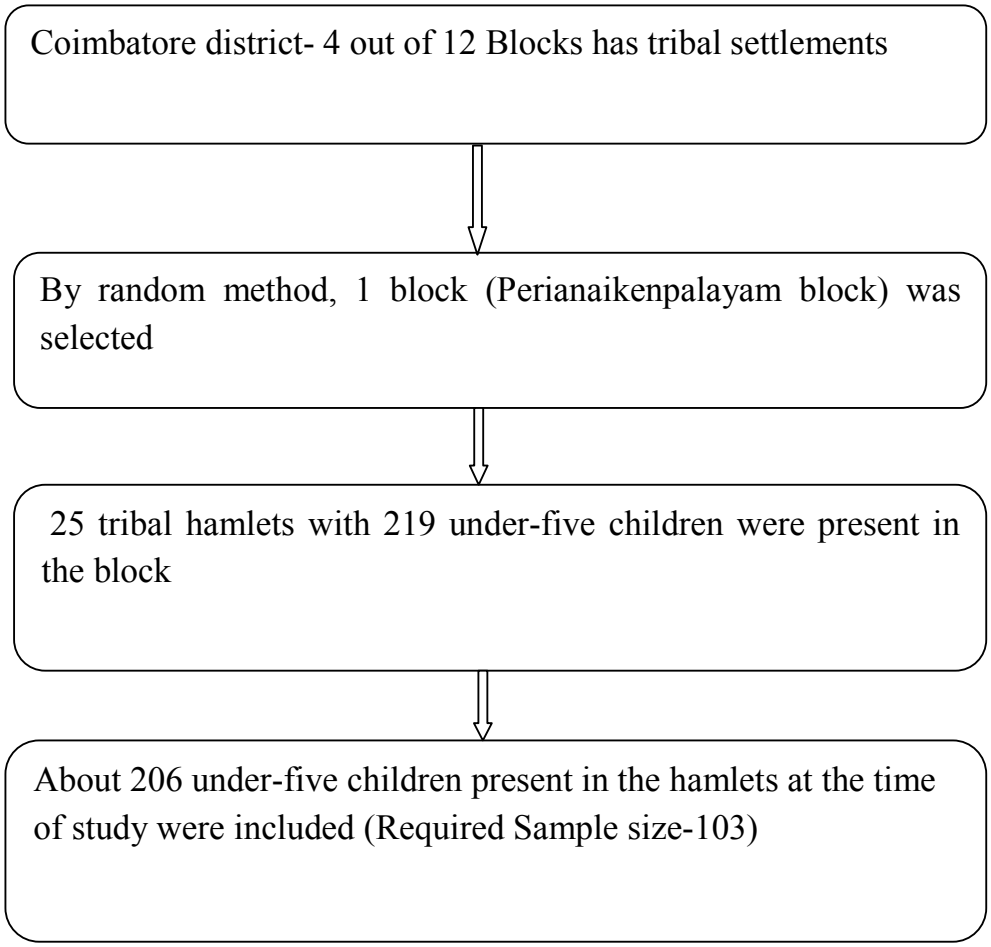


Fig.5 Map showing the Tribal areas in Periyanaickenpalayam block



5.2 Sampling frame

There are 12 Administrative Blocks in Coimbatore. Among these blocks 4 blocks had tribal settlements. By lottery method one block was selected from these 4 blocks. There were 25 tribal hamlets in this block with 219 under-five children population. 206 under-five children who were available at the time of study were included in the study after implementing the exclusion criteria.



5.2.1 Inclusion Criteria

All the children of age 0-59 months who were permanent residents in the 25 tribal hamlets of Periyanaickenpalayam block.

5.2.2 Exclusion Criteria

Under-five children who were not present at home even after three consecutive visits.

5.3 Study design

Cross sectional study

5.4 Study Period

Home-visits were carried out from December 2013 – August 2014.

5.5 Study Area

All the 25 tribal hamlets present in Periyaanaickenpalayam block.

5.6 Sample size determination

With an estimated prevalence of 55% from earlier studies[8] and 20 % allowable error, sample size was calculated using the formula,

$$n = \frac{(1.96^2)pq}{d^2}$$

$$= \frac{3.84\ x\ 55\ x\ 45}{11\ x\ 11}$$

n = 82

Where, n = Number of samples required
p = Prevalence
q = 100 – p
d = allowable error

Non response rate = 20%

$$\text{Sample size} = \frac{82 \text{ x } 100}{80}$$

$$= \mathbf{103}$$

Table1. Hamlet-wise distribution of study subjects

S.No	Name of Hamlet	Number of Children
1.	Alamaramedu	9
2.	Arnatkadu	15
3.	Jammukundi	5
4.	Kandivalli	6
5.	Kilurpathy	5
6.	Kondanur	13
7.	Kondanurpudur	5
8.	Koodanur	13
9.	Kunjurpathy	6
10.	Kuttupulikadu	2
11.	Mangarai	2
12.	Manguli	8
13.	Melurpathy	3
14.	Palamalai	10
15.	Panapalli	13
16.	Pasumani	6
17.	Pasumanipudur	9
18.	Perukupathy	8
19.	Perumpathy	3
20.	Rayarurpathy	12
21.	Sembukarai	3
22.	Thirumalur	31
23.	Thumanur	5
24.	Thuvaipathy	11
25.	Milagayampathy	2
	Total	**206**

There were 206 children in the age group of 0-59 months as per records available at HSC Kovanoor and HSC Anaikatty. Mothers of all these children were interviewed and anthropometric measurements were taken for the children and their mothers who were included for analysis.

5.7 Data collection tools:

Instruments used in data collection

The data collection instruments used in the study included the following:

5.7.1 Physical instrument

The physical instrument used in the study included a weighing scale, a Salter scale, retractable metal measuring tape and an infantometer. All the instruments were calibrated by the Department of Biometrics, PSGIMS&R validated through Best Standard Technologies Private Ltd Chennai (Certificate No: BSM-012501-12) prior to the study.

5.7.2 Questionnaire

A Pre-tested semi structured Questionnaire was presented in the Department for critical review, following which necessary changes were made in the Questionnaire, it was translated into tamil & backtranslated to eliminate loss of meaning. Data was collected using this Pre tested semi structured Questionnaire by interview technique. The parents of children of age group 0-59 months were informed about the study and each question was explained to gather the data about socio-demographic factors, environmental factors, birth history and feeding practices, recent illness, availability of health facilities and their utilization. Simultaneously height and weight of the child and mother were measured.

5.8 Steps in data collection:

After getting approval from the institutional ethics committee, the study was started.

5.8.1 Pilot study:

Pilot study was carried out in a rural area, Neelambur, Coimbatore, which is located outside the field practice area of the Rural Health Training Center of the Community Medicine department, PSG IMSR to identify problems in eliciting the data using the prevalidated instruments.

5.8.2 Data collection for study:

Consent for the participation in the study was obtained from mother. Questionnaire was filled by principal investigator after eliciting the response to the questions.

These twenty-five hamlets of Periyanaickenpalayam block are spread over an area of 15 kilometres and they are nearly 25-35 kilometres away from the Coimbatore city. Access to these areas by means of Public transport system is very difficult due to limited bus services. A government bus reaches to tribal hamlets around Palamalai only twice a day, once in the morning and another time in the evening. Meanwhile a few trips by jeeps help the people in transportation. Most times people reach the health facilities and other accessible areas only by walk.

There are frequent bus facilities to Anaikatty village but reaching the surrounding hamlets of this village is very difficult due to limited bus facilities. Our research team faced difficulties in data collection due to these issues in transportation facilities. The strategy we adopted to overcome these difficulties is to stick on with the Mobile Medical Unit of Periyanaickenpalayam block which start every morning during week days from the Thudialur Government Primary Health Centre, situated nearly 8 Kilometres from our institution. The Mobile Medical Unit covers all the tribal hamlets and provides primary care for the people in a fixed schedule. Our team accompanied with the Mobile Medical Unit according to their Fixed Tour Programme (FTP), after getting permission from the Block Medical Officer (BMO) of Periyanackenpalayam block. Over a period of two months our research team were able to cover all the 25 tribal hamlets and collect data from 206 under five children and their mothers.

Another area in which our research team faced difficulty is that we could not find the child and mother at the same time in their house. The data collection was carried out during the day time and most of the children were out to attend their schools or ICDS centres. In this case the strategy we used to overcome this difficulty is by visiting the schools of the respective children and collecting data from the children after getting permission from the respective school authorities. We also visited the ICDS centres covering our study area to

collect the data. Mothers of the respective children were interviewed in their houses prior to the data collection from the school or ICDS centres.

Plate 1: A view of Dhoomanur hamlet in Anaikatty hills.

Plate 2: Anthropometric measurement of Under-five children in Manguli hamlet of Palamalai hills.

Some of the mothers of these under five children were out during data collection for work or any other purpose and these houses were visited in consecutive days for interview and data collection. Those mothers or children who could not be identified even after three consecutive visits were excluded from the study.

5.8.3 Anthropometric measurements:

Weight and height of all 206 children and their mothers who participated in the study were measured based on WHO recommended procedure.[60]

5.8.3.1 Measurement of weight:

The weight of the children was measured using the conventional standard weighing scale and Salter spring balance for children aged less than two years. These scales were calibrated before commencement of data collection. These scales are widely used in epidemiological studies. With light clothing and without any footwear, children were asked to stand on the platform of weighing scale with body weight evenly distribute between both feet and weight was measured to nearest 0.5 kg. Zero error was set after each measurement.[60]

5.8.3.2 Measurement of height:

Height was measured using a retractable metal measuring tape. Children whose height has to be measured stood on the floor in an erect position without any foot wear with his / her back against the wall. He / she was asked to put

their feet together and move back till their heels touched the bottom of the wall and stretch upwards to the fullest extent with their arms hanging on the side. The head was held in such a way that lower rim of the orbit and auditory canal were in horizontal plane. The height appears in the read off area and measured to nearest 0.5 cm. The supine length was measured in children < than 2 years of age using an infantometer. The child was placed on board with head positioned firmly against the fixed head board, the knees extended by firm pressure and the feet fixed at right angles to the lower legs. Then the up right foot piece was moved to obtain firm contact with the heels and the length was measured to the nearest 0.5 cms.[60]

5.8.4 Assessment of Nutritional status using Anthropometry method

The 2006 WHO Growth Standards for Preschool Children were used for the determination of nutritional status of preschool children. Standard deviation of scores (Z-scores) for weight-for-age, height-for-age and weight-for-height were calculated. The Z-score (SD score) is calculated as follows. The *Z*-score is defined as the deviation of the value observed for an individual from the median of the reference population, divided by the standard deviation (SD) of the reference population.

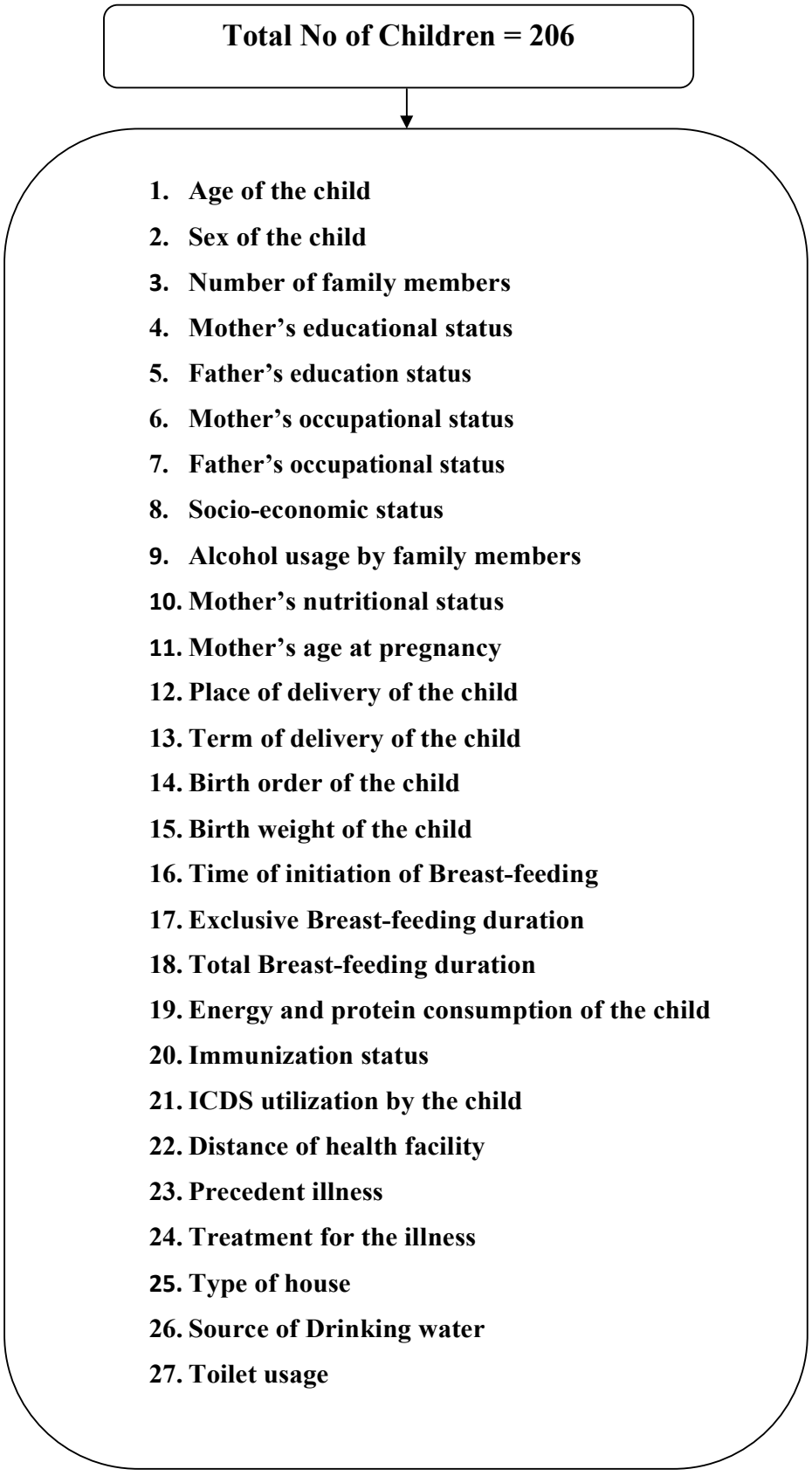
Z score = (individual value-median value of reference population)/ SD value of reference population.

For each of the anthropometric indicators of malnutrition a cutoff point of-2 standard deviations (-2 SD) below the median of that of the WHO reference population was used. Deviation of Z-scores less than – 3SD put children in the severe undernutrition category.

5.8.5 24-Hour Food Recall Method

It is a retrospective assessment method in which the respondent is prompted to recall and describe all foods and beverages consumed in the preceding 24 hours or the preceding day. Portion size estimating aides were carried to assist the respondent to recall amounts consumed. Total Energy and Proteins in terms of calories and grams consumed was calculated for 24 hr period. Percentage of Energy and Proteins consumed in comparison to Recommended Daily Allowance (RDA) by NIN was calculated and the results were analyzed.[66]

Risk factor that were subjected to analysis



5.9 Statistical analysis:

Body Mass Index (BMI) was computed for all mothers using the following formula:

BMI (Kg/m^2) = Weight (Kg) / Height (m^2)

The WHOAnthroII.PC software of WHO was used for analyzing the nutritional status of children.

We assessed the socio economic status (SES) based on Modified Prasad's scale.[61] This classification was based on Consumer Price Index for the month of March 2014.[62] For those, having the per capita income per month of Rs.5000 and above were classified as Class I, Rs.2450 – Rs.4999 as Class II, Rs.1500 – 2449 as Class III, Rs.750 – 1499 as Class IV and per capita income less than Rs. 750 as Class V.

The descriptive statistics (mean and standard deviation) were arrived for weight and height of the children and weight, height and BMI of the mothers.

't' test was used to compare the mean difference between the quantitative variables and chi square test was used to test the association between categorical variables. Prevalence of Malnutrition in the study was based on anthropometric assessment; the exact prevalence of Malnutrition was estimated with 95% confidence interval.

The prevalence of Malnutrition with 95% confidence interval and association of known cases of Malnutrition with selected risk factors were then calculated using logistic regression analysis. The factors considered for the study includes Age of the child (≤1year vs >1 year), Sex of child (Boy vs Girl), Main care-taker (mother vs others), Family members (≤4 vs >4), Mother's educational status (literate vs illiterate), Father's education (literate vs illiterate), Mother's occupational status (working vs not working), Father's occupational status (working vs not working), Socio-economic status (I,II,III,IV and V), Alcohol usage by family members (Yes/No), Mother's nutritional status (underweight vs other category), Mother's age at pregnancy (≤20 vs >20), Place of delivery of the child (institutional vs others), Term of delivery of the child (pre-term vs others), Birth order of the child (≤2 vs >2), Birth weight of the child (<2.5 vs ≥2.5), Time of initiation of Breast-feeding (≤1 hr vs >1 hr), Exclusive Breast-feeding (≤6 months vs >6 months), Total Breast-feeding (≤1 yr vs > 1 yr), Immunization status (Appropriate for age vs Not appropriate for age), ICDS utilization by the child (Yes/No), Distance of health facility (≤3 kms vs >3 kms), Illness in the past fortnight (Yes/No), Illness treated (Yes/No), Type of house (Kutcha, Semi-pucca, and Pucca), Source of Drinking water (Pipe vs other sources), Toilet usage (Toilet vs Open air defeacation),

The variables which were found to have statistically significant association ($p<0.05$) with Malnutrition upon univariate analysis were then

subjected to multivariate logistic regression analysis. Wald statistics was then used to test the significance of the odds ratio. P value <0.05 was considered as statistically significant. Data was entered in Microsoft excel and analyzed using SPSS 19.0 version.

5.10 Operational Definitions

5.10.1 Age: Age was recorded to the nearest completed months after verifying from birth certificates, anganwadi registers and by correlating to the nearby special events.

5.10.2 Illiterate: The person who cannot read and write.

5.10.3 Literate: The person who can read and write.

5.10.4 Birth order: The living siblings were taken into consideration for birth order of living children.

5.10.5 Exclusive breast feeding: Feeding the child with only breast milk for a minimum duration of 6 months (vitamins, minerals and medicines can be given if required for child's health or for minor ailments. A child fed on water; any other liquids or solids during the early 6 months will not be considered as exclusively breast-fed.

5.10.6 Immunization status appropriate for age: Children who had been administered all the recommended vaccines up to one year of age (i.e 1 dose of BCG, 3 doses of DPT, 3 doses of OPV and 1 dose of measles) and booster dose of DPT and OPV in children aged more than 18 years as per UIP guidelines.

5.10.7 Immunization status inappropriate for age: Children who have not received one or more recommended vaccines up to 18 months of age as per UIP guideline.

5.10.8 Pucca house: House where walls are made up of cement and bricks or stones and reinforced cement concrete roof (RCC)

5.10.9 Semi pucca house: House that has brick or stone wall and tiled or asbestos roof

5.10.10 Kutcha house: House which had mud or thatched walls and thatched or tiled/asbestos roof.

5.10.11 Icds utilization: The child / family is considered to be utilizing ICDS services if the child attends one of the Balwadi / ICDS centers more or less regularly. For children less than 1 year of age, their family is considered to be utilizing ICDS,if the mother goes to the ICDS centers to collect the nutritional supplements for the child.

5.10.12 Malnourished: A child is considered to be malnourished if he / she has any one or more of the following.

a. Underweight: Low weight-for-age is termed Underweight. If the child's weight is below -2 SD of the reference median (for that age and sex), he / she is considered underweight and if the weight is below -3 SD, severely underweight.

b. Stunting: Low height-for-age is termed Stunting. If the child's height is below -2 SD of the reference median (for that age and sex), he / she is considered stunted and if the height is below -3 SD, severely stunted.

Wasting: Low weight-for-height is termed Wasting. If the child is below -2 SD of the reference median (for that age and sex), he / she is considered wasted and if below -3 SD, severely wasted.

5.10.13 Tribal children: Children who belong to tribal community and are confirmed by registers available with Village Health Nurses (VHN) or Anganwadi workers. Community statuses of children whose names are not in the registers are confirmed with the Head of the hamlets.

6. RESULTS

Of the 206 children studied, 106 were boys and 100 were girls. The mean (SD) height of the boys was 89.7cm (12.29) and mean (SD) weight of the boys was 12.2kg (3.32). Similarly for girls, the mean (SD) height was 89.6cm (12.72) and mean (SD) weight is 12.2kg (3.44). The mean (SD) BMI of the mothers was 20.2 (2.69).

6.1 Prevalence of Malnutrition:

The primary objective of our study was to find the prevalence of Malnutrition among children aged 1-5 years in a tribal community of Coimbatore district which is situated in the southern part of India. **Table2** shows the prevalence of Malnutrition.

Table 2: Nutritional status of Under-five children (n=206)

Nutritional status	Number	%
Underweight	85	41.3
Wasted	45	21.8
Stunted	67	32.5
Malnourished	**105**	**51**
Normal	**101**	**49**

If the child is either underweight or wasted or stunted then she is considered "Malnourished". The overall prevalence of malnutrition is 51 % as seen from **table2**and 49 % of the children studied are "Normal" anthropometrically. Of these 105 malnourished children, 41.3 % were underweight, 32.5 % were stunted and 21.8 % had wasting.

Table 3: Age sex distribution of Malnourished children

Age group (Months)	Male		Female		Total	
	Total	Malnourished N (%)	Total	Malnourished N (%)	Total	Malnourished N (%)
0-12	9	5(55.6)	10	6	19	11(57.9)
13-24	16	11(68.8)	16	10	32	21(65.6)
25-36	26	15(57.7)	19	10	45	25(55.6)
37-48	26	12(46.2)	28	13	54	25(46.3)
49-60	29	11(37.9)	27	12	56	23(41.1)
Total	**106**	**54(50.9)**	**100**	**51(51)**	**206**	**105(51)**

Table 3 shows the prevalence of malnutrition by age and sex groups. There is no statistically significant difference in prevalence of malnutrition among male and female children in any of the age groups. ($p = 0.18$)

Table 4: Age sex distribution of Underweight children

Age group (Months)	Male			Female			Total		
	Total	Moderate (%)	Severe (%)	Total	Moderate (%)	Severe (%)	Total	Moderate (%)	Severe (%)
0-12	9	4(44.4)	1(11.1)	10	4(40)	2(20)	19	8(42.1)	3(15.8)
13-24	16	5(31.3)	3(18.8)	16	5(31.3)	3(18.8)	32	10(31.3)	6(18.8)
25-36	26	10(30.3)	4(15.4)	19	7(36.8)	1(5.3)	45	17(37.8)	5(11.1)
37-48	26	6(230.1)	2(7.7)	28	7(25)(	2(7.1)	54	13(24.1)	4(7.4)
49-60	29	8(27.6)	3(10.3)	27	6(22.2)	2(7.4)	56	14(25)	5(8.9)
Total	**106**	**33(31.1)**	**13(12.3)**	**100**	**29(29)**	**10(10)**	**206**	**62(30.1)**	**23(11.2)**

Low weight-for-age is termed Underweight. This is a composite measure of malnutrition. There is no statistically significant gender difference in the prevalence of underweight in any of the age-groups. ($p = 0.33$)

Table 5: Age sex distribution of children by degree of Wasting

Age group (Months)	Male			Female			Total		
	Total	Moderate (%)	Severe (%)	Total	Moderate (%)	Severe (%)	Total	Moderate (%)	Severe (%)

0-12	9	0(0)	0(0)	10	1(10)	1(10)	19	1(5.3)	1(5.3)
13-24	16	4(25)	2(12.5)	16	4(25)	0(0)	32	8(25)	2(6.3)
25-36	26	3(11.5)	3(11.5)	19	5(26.3)	0(0)	45	8(17.8)	3(6.7)
37-48	26	2(7.7)	2(7.7)	28	4(14.3)	2(7.1)	54	6(11.1)	4(7.4)
49-60	29	4(13.8)	2(6.9)	27	4(14.8)	2(7.4)	56	8(14.3)	4(7.1)
Total	**106**	**13(12.3)**	**9(8.5)**	**100**	**18(18)**	**5(5)**	**206**	**31(15)**	**14(6.8)**

Low weight-for-height is termed wasting. Wasting reflects a state of acute (short-term) undernutrition. There is no statistically significant gender difference in prevalence of wasting among different age-groups (p = 0.75). Prevalence of wasting increases as the age of the children increases according to **table 5**.

Table 6: Age sex distribution of children by degree of Stunting

Age group (Months)	Male			Female			Total		
	Total	Moderate (%)	Severe (%)	Total	Moderate (%)	Severe (%)	Total	Moderate (%)	Severe (%)
0-12	9	4(44.4)	1(11.1)	10	4(40)	1(10)	19	8(42.1)	2(10.5)
13-24	16	6(37.5)	1(6.3)	16	4(25)	3(18.8)	32	10(31.3)	4(12.5)
25-36	26	12(46.2)	0(0)	19	4(21.1)	1(5.3)	45	16(35.6)	1(2.2)
37-48	26	7(26.9)	2(7.7)	28	5(17.9)	1(3.6)	54	12(22.2)	3(5.6)
49-60	29	4(13.8)	1(3.4)	27	4(14.8)	2(7.4)	56	8(14.3)	3(5.4)
Total	**106**	**33(31.1)**	**5(4.7)**	**100**	**21(21)**	**8(8)**	**206**	**54(26.2)**	**13(6.3)**

Low height-for age is termed stunting. Stunting is indicative of chronic (long-term) undernutrition. There is no statistically significant gender difference in the prevalence of stunting among different age-groups. (p = 0.07)

Table 7: Prevalence of malnutrition in different Socio-economic groups

SES	Total children	Malnourished	
		Number	%

Class I	4(1.9)	0	0
Class II	17(8.3)	1	5.9
Class III	19(9.2)	2	10.5
Class IV	72(35.0)	31	43.1
Class V	94(45.6)	71	75.5
Total	**206 (100)**	**105**	**51**

Table 7 shows the prevalence of malnutrition across different socio-economic classes. There is higher prevalence of malnutrition among the lower socio-economic classes. ($p < 0.001$)

Table 8: Energy and Protein consumption among under-five children (n=206)

RDA (percentage)	Energy		Protein	
	Normal N (%)	Malnourished N (%)	Normal N (%)	Malnourished N (%)
>90	10(9.9)	0(0)	11(10.9)	2(1.9)
71 – 90	14(13.9)	3(2.9)	11(10.9)	4(3.8)
50 – 70	35(34.7)	21(20.0)	62(61.4)	59(56.2)
<50	42(41.6)	81(77.1)	17(16.8)	40(38.1)
Total	**101(49)**	**105(51)**	**101(49)**	**105(51)**

As seen from **Table 8**, 81% of malnourished children are consuming < 50 % of the RDA of Energy. It is interesting to note that 42 % of Normal children according to anthropometry are consuming < 50 % 0f the RDA of Energy. No child in the malnourished category is consuming > 90 % of recommended allowance and only 3 children are consuming > 70 % of the RDA of Energy.

Table 9: Socio-demographic characteristics associated with malnutrition among under-five children

Factors	Category	Total	Malnourished		Unadjusted odds ratio	95% CI*	P value
			N	%			

Age of child	≤1 year	19(9.2)	11	57.9	1	0.28 – 1.91	0.5
	>1 year	187(90.8)	94	50.3	0.735		
Sex	Male	106(51.5)	54	50.9	1	0.58 – 1.73	0.9
	Female	100(48.5)	51	51	1.1		
Main care-taker	Mother	203(98.5)	102	50.2	1	0.27 – 74.64	0.6
	Other	3(1.5)	3	100	2.94		
Any alcoholic	No	35(17)	5	14.3	1	3.12 – 22.84	**<0.001**
	Yes	171(83)	100	58.5	8.45		
Mother's Educational status	Literate	119(57.8)	46	38.7	1	1.86-5.98	**<0.001**
	Illiterate	87(42.2)	59	67.8	3.34		
Father's Educational status	Literate	144(69.9)	49	34	1	7.28-44.94	**<0.001**
	Illiterate	62(30.1)	56	90.3	18.09		
Mother's Occupation Status	Home maker	148(71.8)	88	59.5	1	0.15 – 0.54	**<0.001**
	Working	58(28.2)	17	29.3	0.283		
Total family Members	≤4	102(49.5)	34	33.3	1	2.4 – 7.7	**<0.001**
	>4	104(50.5)	71	68.3	4.3		
SES	Class I, II, III	35(17)	3	8.6	1	4.64 – 33.52	**<0.001**
	Class IV, V	171(83)	102	59.6	15.76		
Mother's BMI	Normal and above	145(70.4)	58	40	1	2.54 – 9.97	**<0.001**
	Under weight	61(29.6)	47	77	5.03		

Univariate analysis was done to explore the association of malnutrition with socio-demographic characteristics of the child. **Table 9** shows the Risk factors that were significantly associated with malnutrition were : Parents being

illiterate, mother not working outside, total family members >4, child belonging to Class IV and Class V SES according to Modified Prasad's classification, Any alcoholic in the family, and Mother being underweight according to her BMI.

There is no statistically significant association in children of different age-group and gender. The children mainly taken care by any other family member other than mother is also not a significant risk factor for malnutrition.

Table 10: Household characteristics associated with malnutrition among under-five children

Factors	Category	Total	Malnourished		Unadjusted odds ratio	95% CI*	P value
			N	%			
Type of house	Pucca	53(25.7)	18	34	1		
	Semi pucca	144(69.9)	80	55.6	2.43	1.20 – 4.95	**<0.01**
	Kutcha	9(4.4)	7	77.8	6.81	1.11 – 53.41	
Water source	Piped water	196(95.1)	96	49	1		
	Well water	10(4.9)	9	90	9.38	1.18 – 101.29	**<0.05**
Toilet	Private /public	36(17.5)	5	13.9	1		
	Open air	170(82.5)	100	58.8	8.85	3.28 – 23.90	**<0.001**

Table10 shows the association of risk factors involving the house-hold environment with malnutrition. Semi-pucca house and kutcha house are significant risk factors compared with a pucca house. Source of drinking water

other than piped water supply and the practice of open air defecation were also significant risk factors for malnutrition.

Table 11: Birth history associated with malnutrition among under-five children

Factors	Category	Total	Malnourished		Unadjusted odds ratio	95% CI*	P value
			N	%			
Mothers age at child birth	< 20	31(15)	24	77.4	**1**	0.10 – 0.61	**<0.05**
	≥ 20	175(85)	81	46.2	0.25		
Place of birth	Hospital/ health centre	184(46.7)	86	46.7	1	2.06 – 25.23	**<0.001**
	Home	22(10.7)	19	86.4	7.21		
Term of delivery	Term	188(91.3)	91	48.4	1	1.18 – 11.75	**<0.05**
	Pre term	18(8.7)	14	77.8	3.73		
Birth weight	Normal	124(60.2)	41	33.1	1	3.78 – 13.69	**<0.001**
	LBW	82(39.8)	64	78	7.19		
Birth order	≤ 2	191(92.7)	95	49.7	1	0.66 – 6.13	0.2
	>2	15(7.3)	10	66.7	2.02		

Taking into consideration of birth history of these under-five children, **Table 11** shows that mother's age less than 20 years during this child birth, deliveries other than institutional deliveries, preterm delivery of this child, and low birth

weight were significant risk factors for malnutrition. Birth order of the child was not a significant risk factor.

Table 12: Infant and young child feeding practices associated with malnutrition among under-five children

Factors	Category	Total	Malnourished		Unadjusted odds ratio	95% CI*	P value
			N	%			
Colostrum given	No	16(7.8)	11	68.8	1	0.14-1.1.33	0.1
	Yes	190(92.2)	94	49.5	0.44		
Breast feeding initiation	≤1hr	171(83)	71	41.5	1	6.40-98.0	**<0.001**
	>1hr	35(17)	34	97.1	47.88		
Exclusive breast-feeding	6months	73(35.4)	19	26	1	2.76-9.73	**<0.001**
	> or <6months	133(64.6)	86	64.7	5.20		
Total breast feeding in children more than 1yr	≥12 months	191(92.7)	93	48.7	1	1.06-19.48	**<0.05**
	<12months	15(7.3)	12	80	4.22		
Other milk in children >6months	Yes	60(30.5)	11	18.3	1	3.73-10.74	**<0.001**
	No	137(69.5)	89	65	8.26		
Calorie consumption(% of RDA)	≥ 50	83(40.3)	24	28.9	1	2.59-8.66	**<0.001**
	< 50	123(59.7)	81	65.9	4.74		
Protein consumption(% of RDA)	≥ 50	149(72.3)	65	61.9	3.04	1.58-5.84	**<0.05**
	< 50	57(27.7)	40	38.1	1		

Correct feeding practices of infant and young child are very essential to the nutritional status of any child. **Table 12** reveals that initiation of breastfeeding more than an hour, breastfeeding the child exclusively for a period less than 6

months, breastfeeding the child for a period less than 1 year, not giving any milk supplements to children above 6 months, consumption of < 50% of the RDA of calories and proteins are significant risk factors for malnutrition. More than 90 % of the children were fed with colostrum after birth. Avoiding colostrum does not turn out to be a risk factor for malnutrition in our study.

Table 13: Illness in the past month associated with malnutrition among under-five children

Factors	Category	Total	Malnourished		Unadjusted odds ratio	95% CI*	P value
			N	%			
Illness present in the last month	No	110(53.4)	39	35.5	1	2.23-7.16	**<0.001**
	Yes	96(46.6)	66	68.8	4.00		
Illness treated among morbid children	Yes	64(66.7)	39	60.9	1	1.07-11.83	**<0.05**
	No	32(33.3)	27	84.4	3.46		

It is evident from **Table13** that under-five children who suffered from any illness in the past month and those children who were not treated for those illnesses were more prone for malnutrition

Table 14: Health service availability and utilization associated with malnutrition among under-five children

Factors	Category	Total	Malnourished		Unadjusted odds ratio	95% CI*	P value
			N	%			

Distance of Health facility	≤3 kms	76(36.9)	43	56.6	1	0.39-1.23	0.218
	>3 kms	130(63.1)	62	47.7	0.70		
Immunization status	Appropriate	187(90.8)	88	47.1	1	1.53-2.36	**<0.001**
	Not appropriate	19(9.2)	17	89.5	1.90		
Attending ICDS	Yes	123(59.7)	77	62.6	1	0.38-0.75	**<0.001**
	No	83(40.3)	28	33.7	0.54		

Table 14 shows the health service availability, its utilization and the association of these factors with malnutrition among the tribal children. Availability of health facility within a radius of 3 kms is not associated with malnutrition and so show that it is protective against getting malnourished.

Children who are not immunized appropriate for age are at significant risk of malnutrition. It is interesting to see that children who are not attending the ICDS centers are having better nutritional status according to anthropometric measurements.

Table 15: Multivariate logistic regression analysis of determinants of malnutrition among Under-five children

S.No	Factors	Category	Adjusted odds ratio	95% Confidence interval	P value
1.	**Father's education**	Literate	1	7.98-15.67	**<0.001**
		Illiterate	10.30		
2.	**Mother's education**	Literate	1	0.22-1.58	0.49
		Illiterate	0.59		
3.	**Mother's occupation**	Home maker	1	0.12-0.99	**<0.05**
		Working	0.35		
4.	**Family members**	≤4	1	0.65-4.13	0.29
		>4	1.63		
5.	**SES**	Class I,II,III	1	1.03-13.80	**<0.05**
		Class IV,V	6.42		
6.	**Mother's nutritional status**	Underweight	1	0.46-3.53	0.63
		Others	1.28		
7.	**Any alcoholic**	Yes	1	0.09-3.15	0.49
		No	0.54		
8.	**Type of house**	Pucca	1	0.15-1.64	0.25
		Semipucca/Kutcha	0.50		
9.	**Piped water supply**	Yes	1	0.33-63.24	0.25
		No	4.58		
10.	**Toilet usage**	Toilet	1	0.51-8.30	0.30
		Open air defecation	2.07		
11.	**Mother's age at birth**	≤20	1	0.42-5.22	0.53
		>20	1.48		

12.	**Place of birth**	Institutional delivery	1	0.33-10.18	0.48
		Home	1.83		
13.	**Term of delivery**	Term	1	0.09-3.35	0.52
		Pre-term	0.56		
14.	**Birth weight**	Normal	1	1.23-9.43	**<0.05**
		LBW	3.41		
15.	**Breast feeding initiation**	Within 1 hr	1	2.58-80.44	**<0.01**
		Above 1 hr	26.92		
16.	**Calorie consumption (% of RDA)**	≥50	1	2.15-16.41	**<0.05**
		<50	5.95		
17.	**Protein consumption (% of RDA)**	≥50	1	0.95-9.90	0.61
		<50	3.07		
18.	**Illness in the past month**	Present	1	0.49-2.97	0.66
		Not present	1.21		
19.	**Attending ICDS**	Yes	1	0.68-4.21	0.25
		No	1.70		
20.	**Immunization status**	Appropriate	1	0.16-6.43	0.97
		Not appropriate	1.02		

Table 15 explored the factors identified from univariate analysis and confirmed those truly associated with malnutrition through multivariate logistic regression analysis. This reveals that:

1. The risk of malnutrition is 10.3 times higher in under-five children of illiterate fathers when compared to literate fathers, but there is no association with the educational status of mother.

2. Occupational status of mothers show significant association with malnutrition of under-five children, where the factor that mothers employed for salary is 65% protective against malnutrition when compared to home-makers.

3. Socio-economic status is significantly associated with malnutrition after logistic regression. Under-five children belonging to Class IV and Class V families according to Modified Prasad's classification have 6.42 times more risk of malnutrition when compared to Class I, Class II and class III families.

4. Low birth weight babies have 3.41 times more risk of suffering from malnutrition when compared to babies who are born normal or overweight.

5. Earlier initiation of breastfeeding, less than an hour after birth is protective for malnutrition in under-five children. Babies who are initiated with breastfeeding after the first hour after birth are 2.9 times more prone for malnutrition.

6. Consumption of calories less than 50% of the RDA proved to be a significant risk factor from the above analysis and protein consumption did not show any statistical association. Children who consume < 50% of recommended calories are nearly 6 times at risk of malnutrition.

7. DISCUSSION

The objective of this study was to find out the prevalence of malnutrition among under-five children in a tribal community and to ascertain the determinants of malnutrition among them. For this purpose a study was conducted among 206 under-five children in 25 tribal hamlets of Periyanaickenpalayam block, Coimbatore.

The possible risk factors selected to find out their association with malnutrition are Age of the child, Sex of the child, Number of family members, Mother's education, Father's education, Mother's occupational status, Father's occupational status, Socio-economic status, Alcohol usage by family members, Mother's nutritional status, Mother's age at pregnancy, Place of delivery of the child, Term of delivery of the child, Birth order of the child, Birth weight of the child, Time of initiation of Breast-feeding, Exclusive Breast-feeding, Total Breast-feeding, Energy and protein consumption of the child, Immunization status, ICDS utilization by the child, Distance of health facility, Recent illness, Treatment for the illness, Type of house, Source of Drinking water and Toilet usage.

Data was collected using Pre tested semi structured Questionnaire by interview technique. The mothers of children of age group 0-59 months were informed about the study and each question was explained to gather the data and simultaneously height and weight of the child and mother were measured. Anthropometric measurements of the children and mothers like height and weight were measured using standardized calibrated instruments as per WHO recommendations.[65] The 2006 WHO Growth Standards for Preschool Children was used to calculate nutritional status of the children and BMI was used to assess the nutritional status of the mothers.

7.1 Prevalence of Malnutrition

Of the 206 children studied, 106 were boys and 100 were girls. If the child is either underweight or wasted or stunted then she is considered "Malnourished". The overall prevalence of malnutrition was 51 % and 49 % of the children studied were "Normal" anthropometrically according to WHO classification. These 105 malnourished children consisted of 41.3 % underweight, of which 11.2 % are severely underweight. Prevalence of stunting is 32.5 %, of which 6.3 % are severely stunted. About 21.8 % children are wasted and 6.8 % are severely wasted among them.

The overall prevalence of Underweight, Stunting and Wasting are 55 %, 54 % and 28 % respectively among under-five children of tribal population in India according to NFHS-3 data.[8] Our study showed a lower prevalence of all three indicators of malnutrition when compared with nationwide statistics.

In a study conducted among tribal under-five children in 9 states of India in 2007-08 among a total of 14,587 children by **NIN**[38], Hyderabad it was found that the overall prevalence of underweight was about 49%, of which 19% were severely underweight. The extent of overall stunting was about 51%, and of them, about 24% were severely stunted. About 22% of children had wasting, of which 7% had severe wasting. Only the degree of wasting is comparable to our study in this context, which may be due to acute causes of malnutrition.

Meshram et al[39], in a study conducted among 1751 tribal children of Maharashtra also showed a higher prevalence of underweight, stunting and wasting as 64%, 61% and 29%, respectively.

Out of 254 Bhil tribal children of Madhya Pradesh, there were 69.3% underweight, 63.4% stunting, and 58.7% wasting according to **Pradhan et al**.[69]. **Roa VG et al**[36] in a study conducted for Regional Medical Research Center for Tribals (ICMR study), Jabalpur, India revealed that 61.6% of preschool children were underweight, 51.6% were stunted and 32.9% were wasted. The study also revealed that severe degree (below -3 SD) of underweight, stunting and wasting

in 27.8%, 30.3% and 6.5% children respectively. Of the 353 children studied by **Dutta A et al**[70] among children in the Garhwal Himalayas, Only 88.7% of the children were stunted while 89.7% were underweight. The difference in indicators of malnutrition here are remarkably high in many of the previously done studies and national statistics when compared to our study.

According to **Bisai et al**[44], in a study conducted among pre-school children of Lodha tribal community of West Bengal, the Overall prevalence of underweight, stunting and wasting was 33.9%, 26.1% and 19.4 %, respectively. Of these, 9.1%, 9.7% and 3.6% children were found to be severely underweight, stunted and wasted. These findings show a slightly lower prevalence when compared to our study.

7.2 Risk Factors for Malnutrition

7.2.1 Age of the child and malnutrition

In our study there is no statistically significant association between different age groups of the under-five children and malnutrition. Our findings are in variance to **Meshram et al**[38] who has reported that there is increased risk of malnutrition in older children when compared with infants, whereas the results of **Bisai et al**[44] is contradictory showing more risk of malnutrition in early childhood(1-3 years) when compared to older children(3-6 years)

7.2.2 Sex of the child and malnutrition

There is no statistically significant difference in prevalence of malnutrition among both the sexes in our study.

Meshram et al[38] has concluded that male under-five children are more prone for underweight, stunting and wasting when compared to girl children. He had also reported an increased risk of malnutrition in boys when compared with girls, in a study conducted in Maharashtra.[39]

7.2.3 Number of family members and malnutrition

In our study if the total number of family members exceeds 4 members, it acts as a risk factor for malnutrition in univariate analysis, not so in regression analysis.

In studies done by **Meshram et al**[38] in India and **Mekonnen H et al**[46] in Ethiopia, the odds for malnutrition is increased in large families (> 4 members) when compared to small families (≤ 4 members). Also there is no association between the main care-taker of the child whether it is the child's mother or others in our study, and this finding correlates with the findings of Seetharaman N, in a study done among slum under-five children in a part of South India.

7.2.4 Mother's education and malnutrition

The unadjusted odd's ratio for malnutrition and mother's educational status shows that there is significant risk if the child's mother is an illiterate in our study.

Nationwide shows that maternal education has a strong inverse relationship with all three measures of nutritional status according to **NFHS-3**[8], also **Meshram I I et**[38] al has reported increased risk of malnutrition in children of illiterate mothers. Underweight was found to be highest among the children whose mothers were illiterate, and the prevalence of decreased as the level of education of the mothers increased according to **Islam S et al.**[71]

7.2.5 Father's education and malnutrition

Illiteracy state of fathers came as very significant risk for malnutrition in under-five children in our study. The adjusted odds of malnutrition were 10.3 times more for children living with illiterate fathers.

The results of our study was consistent with study done by **Meshram I I et al**[38] in India and **Islam et al**[47] in Bangladesh.

7.2.6 Mother's occupational status and malnutrition

The factor that mother's working for salary came as a protective factor for malnutrition when compared to home-makers on logistic regression from

our study. In our study all the fathers were waged workers and we could not elicit the association of malnutrition with father's occupational status.

Our study findings were consistent with the studies done by **Chandran V K P**[43] in Kazhargode district, Kerala and **Girma W et al**[48] in Ethiopia.

7.2.7 Socio-economic status and malnutrition

Children of families belonging to Lower SES were at increased risk of malnutrition when compared to children of higher SES. The results were similar to studies done by **Harishankar et al**[51] and **Reddy D C S et al**[72] in Uttar Pradesh.

NFHS-3[8] also showed that there is a strong association between under nutrition in children and the socio-economic status of the family, where six out of 10 children living in low socio-economic status are stunted and almost as many are underweight whereas, one-quarter of children are stunted and one-fifth are underweight in high socio-economic status children.

7.2.8 Alcohol consumption by any family member and malnutrition

It is a fact that most of the male members in tribal community consume alcohol. This will indirectly affect the working capacity of the member, income of the family, life expectancy and ultimately the expenditure spent on nutrition in their family. The association of any member being an alcoholic in the family is not a significant risk factor according to my study contrary to the above

statement. But a study done by **Saina J** in Nairobi, Kenya involving 170 households has reported that a high percentage (38.1%) of children from alcohol consuming households were underweight, compared to children from non-alcohol consuming households (14.3%).

7.2.9 Mother's nutritional status and malnutrition

NFHS-3[8] data and study done by **Rayhan M I et al**[50] in Bangladesh shows that there is an increased risk of undernutrition in children of mothers belonging to underweight category by BMI classification. In contradiction to their findings our study shows that there is no significant association between mother's nutritional status and children's undernourishment by logistic regression.

7.2.10 Household characteristics and malnutrition

Type of the house (pucca/semi-pucca/kutcha), Source of drinking water supply and usage of toilet facilities when it is available stands as an indicator of standard of living in any community. When we studied about the association of these factors with malnutrition of under-five children, we arrived at the following results.

Factors like inferior type of the house (semi-pucca/kutcha vs pucca), poor source of water supply (such as dug well water, unprotected well, surface water, unprotected spring, river or dam or lake or ponds or canal, rain water, etc), non-

availability and non-usage of available toilet posed as a risk factor for malnutrition in univariate analysis but it did not turn out to be a risk factor after regression analysis.

Many studies have proved that the above mentioned factors are contributory to malnutrition. In a community based study done by **Yadav R J et al**[52] he concluded that severe and moderate levels of malnutrition was much higher among those with poor housing conditions even with the same level of dietary intake, whereas in spite of lower dietary intake , the level of malnutrition was significantly lower among those living in a pucca house.

NFHS-3[8] survey and **Islam M M et al**[47] have reported that poor source of drinking water, non-availability and non-usage of toilet facities are significantly associated with malnutrition among under-five children.

7.2.11 Birth order of the child and malnutrition

There is no significant association between birth order and malnutrition according to our study. Children of higher birth orders are much more likely to be underweight than children of lower birth orders according to **NFHS-3**[8] data. The trends in prevalence of underweight increases as birth order increases.

7.2.12 Birth weight of the child and malnutrition

The association of Low Birth Weight with malnutrition is very much significant in our study with an adjusted odd's ratio of 3.41. Our findings are concordant with various other studies. **NFHS-3**[8] reveals that children with a history of low birth weight (<2.5 kg) are much more likely than other children (≥2.5 kg) to be malnourished. The prevalence of Underweight status among under-five children are 47 percent in LBW (<2.5 kg) babies, 36 percent in babies with 2.5-3 kg birth weight and 26 percent in babies with ≥3 kg birth weight according to **Deolalikar**[45] and also he reveals that LBW status is correlated with maternal nutrition.

7.2.13 Mother's age at child birth and malnutrition

Mother's age ≤20 during child delivery is not a significant risk factor for malnutrition taking into account of adjusted odd's ratio in our study, but **Sonowal C J**[34], in a study conducted in Maharashtra has reported that prevalence of malnourishment in children delivered by mothers before 20 yrs is high (>12%) when compared to children delivered after 20 years (<8%).

7.2.14 Place of child birth and malnutrition

Home deliveries, when compared to institutional deliveries are reported as a significant risk factor for malnutrition by **Biswas S et al**[53] in a community based study done in West Bengal. Home delivery children had 13 times greater risk to be underweight, 5 times greater risk to be stunted and 6 times greater risk

to be wasted than their Institutional delivery counterparts. In our study this factor does not turn out to be a risk factor.

7.2.15 Term of delivery of the child and malnutrition

Under-five children from preterm delivery are not at risk of malnutrition when compared to children from normal or postterm delivery after logistic regression in our study. These results are contradictory to study done by **Moster D et al**[73] in Norway, who has reported that risk of poor physical and social growth is high in preterm children.

7.2.16 Infant and young child feeding practices and malnutrition

Breast feeding initiation after an hour after birth, Exclusive breast-feeding duration less than 6 months in children aged more than 6 months, Total breast feeding duration less than 12 months in children aged more than 12 months, not giving other milk or milk substituent in children >6months and consumption of < 50% of the recommended amount of calories and protein were significant risk factors for malnutrition according to our study. There is no significant association between the child fed with colostrum or not and malnutrition in our study.

Hien NN et al[54] found that duration of exclusive breast feeding < 6 months is a significant risk factor to underweight (OR = 4.41) and stunting (OR = 3.58) and time of initiation of breast feeds was significantly related to underweight (OR = 2.54). His results are in consistency with our study.

Results regarding total breast feeding duration by **Majlesi F et al**[55] in their study in rural Khorambad Province were also consistent with our study. 10.5% of children breast fed for ≤ 1 year were underweight whereas only 4.5% of the children breast fed for 1-2 years were underweight as reported by them.

Mishra et al[57] in their study of 520 under-five children of Varanasi showed that 90% of the malnourished children were consuming < 50% of the RDA of calories and the results were consistent with our study.

Arya A et al[58] in their study among 200 mothers had reported that quantity and frequency of milk and milk products consumed by malnourished children are less when compared to normal children and the intake is associated with the literacy status of the mother.

7.2.17 Precedent illness in the child and malnutrition

Suffering from any illness in the past fortnight and not treating the illness, both were significantly associated with under nutrition in our study. **Meshram et al**[39] from Maharashtra, India and **Mekonnen H et al**[46] from Northwest Ethiopia had reported that children who had suffered any illness in the past

fortnight is at more risk for under nutrition. If we consider health service availability aspect, the recommended distance of any health facility less than 3 kms from the house by Indian Public Health Standards (IPHS) does not have any association with malnutrition.

7.2.18 Immunization status and malnutrition

The factors that the child is not appropriately immunized for age and malnutrition are not significantly associated if we take into account of adjusted odd's ratio in our analysis. Studies done by **Devi P Y et al**[59] in Andhra Pradesh, India and **Mekonnen H et al**[46] of Fogera District, Northwest Ethiopia has shown that under-five children who are appropriately immunized for age were protected against under nutrition.

7.2.19 ICDS attendance and malnutrition

There is a statistically significant association between of ICDS utilization and malnutrition according to our study, and it is interesting to find that non- utilization of ICDS services is found to be a protective factor for malnutrition in our study.

Alim F et al[74] in a study conducted in Aligarh, Uttar Pradesh**,** has reported that out of 23.6% children who did not receive supplementary nutrition from ICDS, majority 14.3 % of the total children were underweight. On the other hand, out of 76.4 % children, who received supplementary nutrition from

ICDS majority 62.7 % of children were having normal weight for age and these results are in variance to our study.

Souza M D et al[75] in their study has revealed that, the presence of anganwadi does not have the intended impact on the nutritional status of the children and these findings are in consistent with our study.

8. SUMMARY

The objective of our study was to find out the prevalence of malnutrition among under-five children in a tribal community of Coimbatore district and to ascertain the determinants of malnutrition among them. Anaikatty and Palamalai tribal areas of Perianaikenpalayam block (population=347062) were selected for our study. There were 25 tribal hamlets in this block with 219 under-five children population. All 206 under-five children who were available at the time of study were included in the study after implementing the exclusion criteria. The tribal people here belong to Irular community. Irulars are small tribal people in the part of Dravidian language group which is spoken in South Eastern India. The population of Irula tribes is 4220(1.6% of the block population) and under-five population among these tribes is 219.

The possible risk factors selected to find out their association with malnutrition are age of the child, sex of the child, number of family members, mother's education, father's education, mother's occupational status, father's occupational status, socio-economic status, alcohol usage by family members, mother's nutritional status, mother's age at pregnancy, place of delivery of the child, term of delivery of the child, birth order of the child, birth weight of the child, time of initiation of breast-feeding, exclusive breast-feeding duration, total breast-feeding duration, energy and protein consumption of the child, immunization status, ICDS utilization by the child, distance of health facility

from the house, recent illness, treatment for the illness, type of house, source of drinking water and toilet usage.

A pilot study was carried out in a rural area, in Neelambur, Coimbatore, which is located outside the study area to identify the need to make changes in the way questionnaire was used as a tool to elicit the information. After obtaining clearance from the Institutional Human Ethics Committee, a cross- sectional study was carried among 206 children aged 0-59 months from the selected tribal hamlets of Periyanaickenpalayam block.

After getting informed consent from the mother, the questionnaire was filled by the Principal Investigator. Data was collected using Pre-tested semi structured Questionnaire by interview technique. The parents of children of age group 0-59 months were informed about the study and each question was explained to gather the data and simultaneously height and weight of the child and mother were measured. Anthropometric indices like height and weight of the child and mother were measured as per WHO guidelines. The 2006 WHO Growth Standards for Preschool Children was used to calculate nutritional status of the children and BMI was used to assess the nutritional status of the mothers

Data was entered in Microsoft excel and analyzed using SPSS 19.0 version. Mean and Standard Deviation was calculated for height and weight of children and BMI of the mothers. Possible risk factors associated with malnutrition were analyzed using univariate analysis and then multivariate logistic regression analysis done to finally identify those that were truly associated with risk of developing malnutrition.

Our study revealed an overall prevalence of malnutrition as 51%. These 51 %(105) malnourished children consisted of 41.3 % underweight, of which 11.2 % were severely underweight. Prevalence of stunting was 32.5 %, of which 6.3 % were severely stunted. About 21.8 % children were wasted and 6.8 % were severely wasted among them.

In our study, socio-demographic factors like total number of family members exceeding four, mother's educational status, father's educational status, mother's occupational status, socio-economic status, alcohol usage by any family member, and mother's nutritional status were found to be significantly associated with malnutrition on univariate analysis.

Birth history associated factors like mother's age at pregnancy, place of delivery of the child, term of delivery of the child, birth weight of the child were also significantly associated with malnutrition. Infant and young child feeding practices like time of initiation of breast-feeding, exclusive breast-feeding

duration, total breast-feeding duration, energy and protein consumption of the child were stastically significant.

Not supplementing with any other milk or milk formulas in children more than 6 months turned out to be a risk factor for malnutrition by univariate analysis. In spite of cattle rearing as one of their occupation it was bothersome to find that nearly 70% of under-five children more than 6 months of age did not receive any milk supplements. The reason here may be due to the lack of awareness of the nutrient value of milk supplementation.

On analyzing factors associated with Health service availability and its utilization- the child's immunization status, ICDS utilization by the child, recent illness and treatment for that illness were significantly associated with malnutrition.

Considering environmental conditions - Type of house, source of Drinking water and toilet usage were found to be significantly associated risk factor for malnutrition upon univariate analysis. Although toilet facilities were available in every hamlet in the form of public toilets, improper maintenance and lack of water supply to those toilets stalled their usage. Community participation is needed at this hour to overcome this problem. Residing people themselves have to take the responsibility of maintaining these toilets and

adequate Health Education must be given by health workers to attain the required knowledge and attitude regarding sanitation.

However, when these associated risk factors were subjected to multivariate logistic regression analysis the variables which came significant were

- Father's educational status
- Mother's occupational status
- Socio-economic status
- Birth weight of the child
- Time of initiation of Breast-feeding and
- Daily Energy consumption of the child

Most of these are known risk factors for malnutrition but the local factors influencing malnutrition should be kept in mind when planning future information education and communication programs in this area.

Father's educational status which will obviously reflect in their occupational status and ultimately in their Socio-economic status is significantly associated with malnutrition. Even mother's occupational status which is significantly associated with malnutrition will reflect the same improved Socio-economic status. So, it is found from our study that Socio-economic factor is a key determinant for malnutrition.

Birth weight of any child is always determined by the level of Ante-natal care received by the mother, and it is obvious from our study that Low Birth Weight (LBW) which is consequence of poor ante-natal care is more prevalent among the tribal community. The knowledge regarding correct breastfeeding practices and provision of energy-rich, locally available food is poor among tribal mothers and health workers must educate them regarding proper infant and young children feeding practices.

Nearly 66% of the malnourished children are consuming less than 50% of their Recommended Dietary Allowances of energy. The observed state of poor nutrition among the children goes hand in hand with the adverse social, economic, environmental factors and unsanitary conditions the children grow in, where 83% of the families have a percapita income of less than 1500 per month, more than 82% of the families practicing open air defecation, and 83% of the families have one or more alcoholics in their family.

There is a significant difference in the prevalence of malnutrition among the ICDS beneficiaries and non-beneficiaries, and it is awful to see that the prevalence of malnutrition is more among ICDS beneficiaries. The reason may be due to fruitless functioning of the National program in this area or may be that only low SES people are utilizing ICDS services. In any circumstance the reason for this variability has to be explored and remedial action should be taken in near future.

This study establishes the extent of problem of malnutrition coupled with problems arising due to low SE Status, Low Birth Weight arising due to poor ante-natal history, etc and so requires urgent attention to reduce the burden of malnutrition among under-five children thus preventing them from increased risk of disease morbidity and mortality in later life.

The basic problem of the tribal people is poverty. The problems of low standard of living, hunger, starvation, malnutrition, agricultural illiteracy, poor antenatal care, disease, poor sanitary and housing facilities, etc has to be improved totally by implementation of policy that already exists.

9. LIMITATIONS

1. Since it is a cross sectional study, no causal relationships can be established from this study.

2. Dietary intake was assessed by 24-hour recall basis method since application of better and elaborate methods of dietary intake assessment was beyond the scope of the study given the time and resource constraints.

3. Assessment of birth history, breast-feeding practices, and illness in the past was based on recall memory of the mothers. There could be some possible element of recall bias due to usage of questionnaire method which elicits recall of the data from the past.

4. The sample size for the study was determined for arriving at prevalence of malnutrition. The same is not applicable (not adequate) for studying the association of malnutrition with the selected risk factors. Hence we need to have a larger sample size to establish rarer risk factors associated with malnutrition.

10. RECOMMENDATIONS

1. Socio-economic development among the tribal masses needs to be ensured which is the important factor to tackle malnutrition, mainly undernutrition.

2. Female literacy and empowerment is the need of the hour, as this will influence the socio-economic status of the family which in turn improves the nutrition and wellbeing of family and children in particular.

3. Infant and young child feeding practices have to be addressed rightly to see that the appropriate practices are followed to ensure compliance with dietary RDA components. This has not been achieved by VHNs and Anganwadi workers. Hence the use of peer group counsellors and positive deviant mothers as exemplars has to be considered seriously. To achieve operational efficiency in the health care delivery programs, efforts should be made to involve local tribes in these programs.

4. Nutrition education has to be imparted to the people regarding consumption of cost-effective nutritious diet, which could provide necessary nutrients with change of dietary practice to the vulnerable families and segments of the society.

5. Environmental sanitation will go a long way in curbing infection and breaking the vicious cycle of infection leading to under nutrition.

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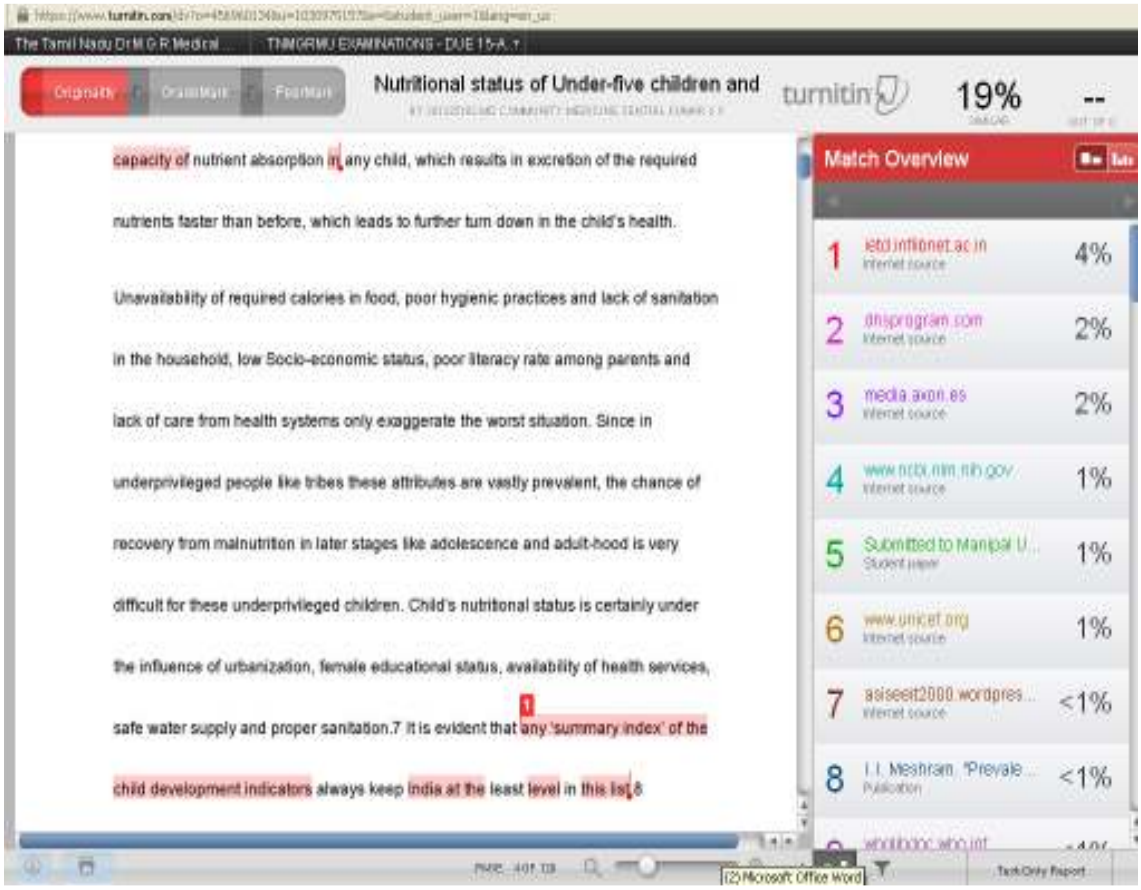
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capacity of nutrient absorption in any child, which results in excretion of the required
nutrients faster than before, which leads to further turn down in the child's health.
Unavailability of required calories in food, poor hygienic practices and lack of sanitation
in the household, low Socio-economic status, poor literacy rate among parents and
lack of care from health systems only exaggerate the worst situation. Since in
underprivileged people like tribes these attributes are vastly prevalent, the chance of
recovery from malnutrition in later stages like adolescence and adult-hood is very
difficult for these underprivileged children. Child's nutritional status is certainly under
the influence of urbanization, female educational status, availability of health services,
safe water supply and proper sanitation.7 It is evident that any 'summary index' of the
child development indicators always keep India at the least level in this list.8
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Institutional Human Ethics Committee

Recognized by The Strategic Initiative for Developing Capacity in Ethical Review (SIDCER)
POST BOX NO. 1674, PEELAMEDU, COIMBATORE 641 004, TAMIL NADU, INDIA
Phone : 91 422 - 2598822, 2570170, Fax : 91 422 - 2594400, Email : ihec@psgimsr.ac.in

March 28, 2014

To
Dr S K Senthil Kumar
Postgraduate
Department of Community Medicine
PSG IMS & R
Coimbatore

The Institutional Human Ethics Committee, PSG IMS & R, Coimbatore -4, has reviewed your proposal on March 14, 2014 in its expedited review meeting held at IHEC Secretariat, PSG IMS&R, between 10.00 am and 11.00 am, and discussed your study proposal entitled:

"Nutritional status of under-five children and its determinants in a tribal community of Coimbatore district"

The following documents were received for review:

1. Duly filled application form
2. Proposal
3. Parental Consent Form
4. Data Collection Tool
5. CV
6. Budget

After due consideration, the Committee has decided to approve the study.

The members who attended the meeting at which your study proposal was discussed are as follows:

Name	Qualification	Responsibility in IHEC	Gender	Affiliation to the Institution Yes/No	Present at the meeting Yes/No
Dr P Sathyan	DO, DNB	Clinician, Chairperson	Male	No	Yes
Dr S Bhuvaneshwari	M.D	Clinical Pharmacologist Member - Secretary	Female	Yes	Yes
Dr Sudha Ramalingam	M.D	Epidemiologist Alt. Member - Secretary	Female	Yes	Yes
Dr Y S Sivan	Ph D	Member –Social Scientist	Male	Yes	Yes
Dr D Vijaya	Ph D	Member – Basic Scientist	Female	Yes	Yes

The approval is valid for one year.

We request you to intimate the date of initiation of the study to IHEC, PSG IMS&R and also, after completion of the project, please submit completion report to IHEC.

PSG Institute of Medical Sciences & Research
Institutional Human Ethics Committee

Recognized by The Strategic Initiative for Developing Capacity in Ethical Review (SIDCER)
POST BOX NO. 1674, PEELAMEDU, COIMBATORE 641 004, TAMIL NADU, INDIA
Phone : 91 422 - 2598822, 2570170, Fax : 91 422 - 2594400, Email : ihec@psgimsr.ac.in

This Ethics Committee is organized and operates according to Good Clinical Practice and Schedule Y requirements.

Non-adherence to the Standard Operating Procedures (SOP) of the Institutional Human Ethics Committee (IHEC) and national and international ethical guidelines shall result in withdrawal of approval (suspension or termination of the study). SOP will be revised from time to time and revisions are applicable prospectively to ongoing studies approved prior to such revisions.

Kindly note this approval is subject to ratification in the forthcoming full board review meeting of the IHEC.

Yours truly,

SECRETARY
PSG IMSR
COIMBATORE-641004.
INSTITUTIONAL HUMAN ETHICS COMMITTEE

28-3-14

Dr S Bhuvaneshwari
Member - Secretary
Institutional Human Ethics Committee

Annexure III

PSG Institute of Medical Science and Research, Coimbatore
Institutional Human Ethics Committee
INFORMED CONSENT FORMAT FOR RESEARCH PROJECTS

(Strike off items that are not applicable)

I **Dr.S.K.Senthil Kumar** carrying out a study on the topic:

Nutritional status of Under-five children and its determinants in a tribal community of Coimbatore district.

as part of my research project being carried out under the aegis of the DEPARTMENT OF COMMUNITY MEDICINE.
(*Applicable to students only*): My research guide is:

DR.THOMAS V CHACKO and DR.SUVETHA

The justification for this study is:
Children below 5 years of age in scheduled tribes and scheduled castes are twice as likely to be malnourished than children in other groups. Infant Mortality Rates are similar across all rural population including tribes, but by age 5 Scheduled Tribe children are at much greater risk of dying. Based on extensive literature search, not many studies on malnutrition among under-five children are done in tribal areas of South India. Hence in our present study we intend to find out the prevalence of malnutrition and it's determinants in a tribal community of Coimbatore situated in the state of Tamilnadu.

The objectives of this study are:
1. To find out the prevalence of malnutrition among under-five children in a tribal community.
2. To ascertain the determinants of malnutrition among them.

Sample size: 219
Study volunteers / participants are (specify population group & age group):

All under-five children in 25 tribal hamlets of Periyanaickenpalayam block of Coimbatore district.

Location:
Tribal hamlets in Palamalai and Anaikatty area of Periyanaickenpalayam block of Coimbatore district.

We request you to kindly cooperate with us in this study. We propose collect background information and other relevant details related to this study. We will be carrying out:

Initial interview (specify approximate duration): 10 minutes

Data collected will be stored for a period of FIVE years. We will / will not use the data as part of another study.

Health education sessions: NOT APPLICABLE

Clinical examination (Specify details and purpose): Height and weight of the child and mother will be measured to calculate their nutritional status

Blood sample collection: NOT APPLICABLE

Medication: NOT APPLICABLE

Final interview:. NOT APPLICABLE

If **photograph** is taken, purpose: FOR DISSERTATION PURPOSE

Benefits from this study:

1. Prevalence of Malnutrition in under-five children will be estimated
2. Determinants of Malnutrition in these under-five children will be found

Risks involved by participating in this study: NO RISK

How the **results** will be used: FOR DISSERTATION AND PUBLICATION.
If you are uncomfortable in answering any of our questions during the course of the interview you **have the right to withdraw from the interview / study at anytime.** You have the freedom to withdraw from the study at any point of time. Kindly be assured that your refusal to participate or withdrawal at any stage, if you so decide, will not result in any form of compromise or discrimination in the services offered nor would it attract any penalty. You will continue to have access to the regular services offered to a patient. You will **NOT** be paid any remuneration for the time you spend with us for this interview / study. The information provided by you will be kept in strict confidence. Under no circumstances shall we reveal the identity of the respondent or their families to anyone. The information that we collect shall be used for approved research purposes only. You will be informed about any significant new findings - including adverse events, if any, – whether directly related to you or to other participants of this study, developed during the course of this research which may relate to your willingness to continue participation.
Consent: The above information regarding the study, has been read by me/ read to me, and has been explained to me by the investigator/s. Having understood the same, I hereby give my consent to them to interview me. I am affixing my signature / left thumb impression to indicate my consent and willingness to participate in this study (i.e., willingly abide by the project requirements).
Signature / Left thumb impression of the parents:

Signature of the Interviewer with date: Witness:

பெற்றோர் ஒப்புதல் படிவம்

ஆய்வின் தலைப்பு : கோயம்புத்தூரில் உள்ள ஒரு பழங்குடியினர் பகுதியில் ஐந்து வயதிற்குட்பட்ட குழந்தைகளிடம் காணப்படும் ஊட்டச்சத்துக் குறைபாடு.

ஆய்வாளரின் பெயர் : டாக்டர்.சி.கா.செந்தில்குமார்

துறை : சமூகவியல் துறை

உங்கள் குழந்தை இவ்வாய்வில் கலந்து கொள்ள வரவேற்கப்படுகிறது. நான் உங்கள் குழந்தையை பங்கேற்க சம்மதம் கோருவது ஏனென்றால், இவ்வாய்வினை மேற்கொள்ள எனக்கு 219 குழந்தைகள் தேவைப்படுகிறது. நீங்கள் சம்மதித்தால் உங்கள் குழந்தையின் உயரம் மற்றும் எடை அளக்கப்படும்.

இந்த ஆய்வில் கிடைக்கும் தகவல்கள் அனைத்தும் இரகசியமாக பாதுகாக்கப்படும். உங்கள் சம்மதமில்லாமல் யாருக்கும் தெரிவிக்கப்படமாட்டாது. இவை வேறு எந்த ஆய்வுக்கும் பயன்படுத்தப்படமாட்டாது.

இந்த ஆய்வினைப்பற்றி ஏதேனும் சந்தேகங்கள் இருந்தால் என்னிடம் கேட்கலாம். எந்த கேள்விகளாயிருந்தாலும் 9894033431 என்ற எண்ணல் தொடர்பு கொண்டு கேட்கலாம். உங்கள் குழந்தையின் பங்கேற்பைப்பற்றி 9894033431 என்ற எண்ணில் தொடர்பு கொண்டு தெரிந்து கொள்ளலாம்.

இந்தப்படிவத்தின் நகலை நீங்கள் வைத்துக் கொள்ளலாம்.

இந்த ஆய்வில் உங்கள் குழந்தை பங்கேற்பது உங்களின் சொந்த முடிவே. உங்களின் கையெழுத்து உங்கள் குழந்தை பங்கேற்பதற்கான சம்மதமாக கருதப்படும். இந்த ஆய்விலிருந்து எப்போது வேண்டுமானாலும் நீங்கள் விலகிக் கொள்ளலாம். அதைப்பற்றி என்னிடம் தெரிவிக்கவும்.

குழந்தையின் பெயர்

தாயாரின் கையொப்பம் **ஆய்வாளரின் கையொப்பம் (தேதியுடன்)**

Annexure IV

QUESTIONNAIRE TO MOTHER

Participant ID No :

Name of the Hamlet :

Date of interview :

Socio- Demographic factors

1. Name of Child : 2. Sex:

3. Date of Birth : 4. Age: months

5. Main care – taker of the child: Mother /other

6. Mother's Details

1. Illiterate
2. Primary
3. Secondary
4. Higher Secondary
5. Graduate

7. Father's details

1. Illiterate
2. Primary
3. Secondary
4. Higher Secondary
5. Graduate

8. Employment:

9. Employment:

Family Details

10. Total number of family members:

11. Type of family: Nuclear / Joint / Extended

12. Total Family income / month: Rs.

13. Alcohol usage by any of the family members? Yes /No

14. Money spent for alcohol per month by the family: Rs.

Maternal and child health

15. Mother's Age at birth of this child: [ ]

16. Place of birth: Hospital / Health centre / Home / Other (Specify) :

17. Details about the delivery of this child: Term / Pre Term / Post Term

18. Was the child weighed at birth? : Yes / No

19. If yes, what was the Birth Weight? [ ]

20. Birth order of this child: [ ]

21. Was the child fed with colostrum after birth? Yes / No

22. How long after the birth was this child breast – fed? [ ] minutes

23. Duration of breast – feeding: a) Exclusive: [ ] months

b) Total : [ ] months

24. When did you start giving food other than breast milk? [ ] months

25. Appropriately immunized for age : Yes / No

26. ICDS Beneficiary : Yes / No

27. Whether growth card is available with the mother? : Yes / No

28. Whether growth monitoring is done in Anganwadi Centre? : Yes/No

29. What is the nearest health facility from your House? : [ ]

30. What is the distance for the nearest health facility from your house? : [ ] kms

31. Illness of the child in the past fortnight and its treatment:

Morbidity	Treated?		Where was the child treated?
	Yes	No	
Intestinal : 1. Diarrhea 2. Worms			
Respiratory :			
Skin :			
Others :			

32. If not treated at any health facility – why? :

Housing and Environment

33. Type of the house: Kutcha/Semi-Pucca / Pucca

34. Number of rooms in the house: ☐

35. Source of Drinking water: Tap in house / Tap in street / well water / others

36. Storage of Drinking water:

a) Pot / Tank / others

b) Closed / not closed

37. Toilet Facility:

In the house / Public toilet / open air defecation

Dietary Intake (24 Hour recall method)

38. Energy and protein intake of the child in the previous day:

	Food consumed	**Energy (Kcal)**	**Protein (Grams)**
Morning			
Noon a) ICDS b) House			
Evening / In - between			
Night			

39. Whether the child is breast fed now: Yes / No

a) If yes, how many times will you breastfeed per day: Yes / No

b) If no i) what other milk do you feed? : ……..…..

ii) How much do you feed/day? : …….……

Physical Examination

Child:

40. Child's weight: ☐ Kg(s)

41. Child's Height: ☐ cms

Mother:

42. Mother's weight: ☐ Kgs

43. Mother's height: ☐ cms

Thanking you!!!

தாயாரிடம் கேட்கப்படும் கேள்விகள்

குழந்தையின் அடையாள எண் :

பழங்குடியின் கிராமத்தின் :

நேர்காணல் நடக்கும் தேதி :

சமூக விவரங்கள் :

1. குழந்தையின் பெயர் : 2. பாலினம் :

3. குழந்தை பிறந்த தேதி : 4. குழந்தையின் வயது : மாதங்கள்

5. குழந்தையை கவனித்துக் கொள்பவர் : தந்தை/தாய்/மற்றவர்கள்

தாயின் விவரங்கள்		**தந்தையின் விவரங்கள்**	
6. கல்வித்தகுதி :		7. கல்வித்தகுதி	
i) படிப்பறிவு இல்லை		i) படிப்பறிவு இல்லை	
ii) ஐந்தாவது வரை		ii) ஐந்தாவது வரை	
iii) பத்தாவது வரை		iii) பத்தாவது வரை	
iv) பன்னிரெண்டாவது வரை		iv) பன்னிரெண்டாவது வரை	
v) கல்லூரிப்படிப்பு		v) கல்லூரிப்படிப்பு	
8. தொழில் :		9. தொழில் :	

குடும்ப விவரங்கள் :

10. குடும்பத்தின் மொத்த உறுப்பினர்கள் :

11. குடும்ப வகை : தனிக்குடும்பம் / கூட்டுக்குடும்பம் / விரிவுபட்ட குடும்பம்

12.குடும்பத்தின் மாத வருமானம் : ரூபாய்

13. குடும்பத்தில் யாராவது மது உட்கொள்கின்றனரா? ஆம் /இல்லை

14. மதுவிற்காக மாதந்தோறும் செலிவடும் தொகை : ரூபாய் [ ]

தாய், நேய் நல விவரங்கள்

15. இந்தக்குழந்தை பிறந்த போது தாயின் வயது : [ ] வருடங்கள்

16. குழந்தை பிறந்த இடம் : ஆஸ்பத்திரி / சுகாதார மையம் / வீடு / மற்றவை

17. பிரசவத்தின் தன்மை : கெடுவில் பிறந்தது/கெடுவிற்கு முன் பிறந்தது/ கெடுவிற்கு பின் பிறந்தது

18. குழந்தை பிறந்தபோது அதன் எடை பார்க்கப்பட்டதா? ஆம் / இல்லை

19. ஆம் என்றால், பிறப்பு எடை எவ்வளவு? [ ] கிலோ

20. குழந்தையின் பிறப்பு வரிசை : [ ]

21. குழந்தை பிறந்தவுடன் சீம்பால் கொடுக்கப்பட்டதா? ஆம் / இல்லை

22. குழந்தை பிறந்து எவ்வளவு நேரத்திற்குள்

தாய்ப்பால் கொடுக்கப்பட்டது : [ ] நிமிடங்கள்

23. தாய்ப்பால் கொடுக்கப்பட்ட காலம் :

அ) தாய்ப்பால் மட்டும் : [ ] மாதங்கள்

ஆ) மொத்தமாக தாய்ப்பால் கொடுத்த காலம் : [ ] மாதங்கள்

24. தாய்ப்பாலுடன் இணை உணவை எப்போது ஆரம்பித்தீர்கள்? : [ ] மாதங்கள்

25. வயதுக்குத் தக்க தடுப்பூசி போடப்பட்டுள்ளதா? : ஆம் /இல்லை

26. குழந்தை அங்கன்வாடி சேவைகளை உபயோகப்படுத்துகிறதா?: ஆம்/இல்லை

27. குழந்தையின் வளர்ச்சி அட்டவணை தங்களிடம் உள்ளதா? : ஆம் /இல்லை

28. குழந்தையின் வளர்ச்சி தற்போது வரை அங்கன்வாடியில்

கண்காணிக்கப்பட்டுள்ளதா? : ஆம்/இல்லை

29. உங்கள் வீட்டின் அருகாமையில் உள்ள மருத்துவமையம் என்ன?: ----------

30. மருத்துமையத்தின் தூரம்எவ்வளவு? : [ ] கி.மீ.

31. கடந்த ஒருமாதத்தில் குழந்தைக்கு ஏற்பட்ட உடல்நலக்குறைபாடு மற்றும் அதற்கான

சிகிச்சை அளித்த இடம் :

உடல்நலக்குறைபாடு	**சிகிச்சையளிக்கப்பட்டதா?**		**எங்கு சிகிச்சையளிக்கப்பட்டது**
	ஆம்	**இல்லை**	
i) இரைப்பை குடல் நோய் அ) வயிற்றுப்போக்கு ஆ) வயிற்றுப்பூச்சி			
ii) சுவாசம் சம்பந்தப்பட்ட நோய்			
iii) தோல் சம்பந்தப்பட்ட நோய்			
iv) மற்றவை			

32.சிகிச்சையளிக்கப்படவில்லை என்றால் அதற்கான காரணம்:

வீடு மற்றும் சுற்றுச்சூழல் சார்ந்த விவரங்கள் :

33. வீட்டின் வகை : கூரை/ஓடு/காரை

34. வீட்டின் மொத்த அறைகள் : [ ]

35. குடிதண்ணீர் எங்கிருந்து பெறப்படுகிறது : வீட்டிலுள்ள குழாய்/

தெருவிலுள்ள குழாய் / கிணறு/ மற்றவை

36. குடிதண்ணீர் சேமித்து வைக்கும் விவரம் :

அ) குடங்கள் / தொட்டி / மற்றவை

ஆ) மூடிவைக்கப்பட்டுள்ளதா : ஆம் / இல்லை

37. கழிப்பறை வசதி : வீட்டிலுள்ள கழிப்பறை / பொதுக்கழிப்பறை /

திறந்த வெளிக்கழிப்பிடம்

உணவு முறைகள் :

38. ஒரு சராசரி நாளில் குழந்தை உட்கொள்ளும் உணவின் அளவு :

	உட்கொண்ட உணவு	சக்தி (கி.கலோரி)	பரதம் (கிராம்)
காலை			
மதியம் : அ) அங்கன்வாடி ஆ) வீடு			
மாலை /சிற்றுண்டி			
இரவு			

39. குழந்தைக்கு தற்போது தாய்ப்பால் கொடுக்கப்படுகிறதா : ஆம் / இல்லை

அ) ஆம் என்றால் தாய்ப்பால் நன்றாக சுரக்கிறதா ? ஆம் / இல்லை

ஆ) இல்லையென்றால் i) வேறு என்ன பால் கொடுக்கிறீர்கள் :

ii) எவ்வளவு கொடுக்கிறீர்கள் :

உடல் பரிசோதனை :

குழந்தை :

40. எடை : [ ] கிலோ

41. உயரம் : [ ] செ.மீ

தாய் :

42. எடை : [ ] கிலோ

43. உயரம் : [ ] செ.மீ

நன்றி

Annexure V

Modified Prasad's classification

Value of Consumer Price Index – Industrial Workers (CPI – IW) for March 2014= 219 (for Coimbatore; Base 2001 =100)

The calculation as per Modified Prasad's classification has to be done using the following formula:

To convert the March 2014 CPI of 219

$$= 219 \times 4.63 = 1013.97$$

The calculation as per Modified Prasad's classification was done using the following formula:

$$\text{Multiplication factor} = \frac{(\text{Value of CPI X } 4.63) \times 4.93}{100}$$

$$= \frac{1013.97 \text{ X } 4.93}{100} = 49.99$$

Socio-economic Status	Per capita monthly income limits
CLASS I	**Rs. ≥5000**
CLASS II	**Rs 2450- 4999**
CLASS III	**Rs1500-2449**
CLASS IV	**Rs 750-1499**
CLASS V	**Rs < 750**

Annexure VI

Coding sheet for master chart

1. Sex

Male	1
Female	0

2. Age group

0-12months	1
13-24months	2
25-36months	3
37-48months	4
49-59months	5

3. Paternal and maternal education status

Illiterate	1
Primary school	2
Secondary school	3
Higher secondary	4
Graduate	5

4. Socio-Economic Status (SES)

Upper	1
Upper Middle	2
Lower Middle	3
Upper Lower	4
Lower Lower	5

5. Main care taker of the child

Mother	0
Other	1

6. Total family members

≤ 4 members	0
> 4 members	1

7. Any alcoholics in the family

No alcoholic	0
Alcoholic present	1

8. BMI of Mother

Underweight	0
Normal	1
Overweight	2
Obese1	3
Obese2	4
Obese3	5

9. Place of birth

Hospital	1
Health center	2
Home	3
Others	4

10. Term of delivery

Term	1
Preterm	2
Post-term	9

11. Age of the mother during this child birth

≤ 20 yrs	0
> 20 yrs	1

12. Birth order of the child

≤ 2	0
> 2	1

13. Birth weight of the child

Normal	0
LBW	1

14. Breastfeeding Initiation

≤ 1 hr	0
> 1 hr	1

15. Exclusive breastfeeding duration in children more than 6 months

≥ 6 months	0
< 6 months	1

16. Total breastfeeding duration in children aged more than 1 year

≥ 1 yr	0
< 1 yr	1

17. Provision of milk or milk substituent for children aged > 6 months

Yes	0
No	1

18. Consumption of nutrients per day (% of RDA of Energy and Proteins)

<50	1
50-70	2
71-90	3
>90	4

19. Ilness in the past fortnight

Nil	0
ADD	1
ARI	2
Skin infection	3
Others	4

20. Distance of Health facility from house

≤ 3 kms	0
> 3 kms	1

21. Immunization status

Appropriate for age	0
Inappropriate for age	1

22. ICDS utilization

Yes	0
No	1

23. Type of house

Kutcha	1
Semi-pucca	2
Pucca	3

24. Source of Drinking water

House tap	1
Street tap	2
Well	3
Others	4

25. Toilet usage

House toilet	1
Public toilet	2
Open air defecation	3

MASTER CHART

Id.No	sex	age group	Child's wt	Child's ht	Mother's wt	Mother's ht	BMI of Mother	mother's education	father's education	SES	Care taker	No of family members	Family type	Any Alcoholic	place of birth	term of delivery	Age of mother at child birth	Birth order	Birth wt	Breatfeeding Initiation	Exclusive breast feeding	Total Breast breast feeding	Energy consumed per day	Protein consumed per day	Other milk	type of house	source of drinking water	Toilet usage	Ilness in past fortnight	Distance of Health facility	Immunization status	ICDS utilization
1	1	2	8	63	49	145	0	4	2	4	0	7	2	1	1	1	0	0	0	0	0	0	1	1	1	3	2	3	0	0	0	1
2	0	5	6	61	48	150	1	3	1	4	0	4	1	1	1	1	0	0	0	0	1	0	4	2	1	2	2	3	0	1	0	1
3	0	3	7	61	53	155	1	3	1	4	0	4	1	1	1	1	0	0	0	0	1	0	2	2	1	2	2	3	0	1	0	1
4	0	5	7	63	47	150	1	2	2	5	0	5	1	1	1	1	0	1	0	0	1	1	1	2	1	2	3	3	0	1	0	1
5	0	5	9	79	36	144	1	2	3	4	0	3	1	1	1	2	0	0	1	0	0	0	1	2	1	2	2	3	0	1	0	1
6	0	5	16	105	47	148	1	1	2	5	0	6	1	1	3	1	0	1	1	0	0	0	1	2	1	2	2	3	0	1	0	0
7	1	1	9	80	42	147	1	1	2	5	0	6	1	1	1	1	0	1	0	0	1	0	2	1	1	1	2	3	4	1	0	1
8	0	3	12	92	43	148	1	2	2	4	0	4	3	1	1	1	0	0	0	0	1	0	1	2	1	2	2	3	2	1	0	0
9	0	2	10	80	40	152	1	1	3	5	0	6	3	1	1	1	0	1	0	0	0	0	1	1	0	2	2	3	0	1	0	0
10	0	3	16	96	55	150	1	2	2	4	0	4	1	1	1	1	0	0	0	0	1	0	4	2	1	2	2	3	0	1	0	0
11	1	2	16	98	35	142	1	2	2	5	0	7	3	1	1	1	0	1	0	0	0	0	1	2	0	2	2	3	0	1	0	1
12	0	3	25	106	45	149	1	2	2	5	0	7	3	1	1	1	0	0	0	0	0	0	3	1	0	2	2	3	0	1	0	1
13	0	4	18	106	45	141	1	2	2	4	0	5	3	1	1	1	0	0	0	0	1	0	2	2	0	2	2	3	0	1	0	1
14	0	2	15	103	39	145	0	5	5	2	0	4	3	0	1	1	0	0	0	0	0	0	1	2	1	3	1	1	0	0	0	1
15	1	4	18	106	50	152	1	3	3	4	0	5	3	1	1	1	0	0	0	0	1	0	4	4	0	2	2	1	2	0	0	1
16	0	5	18	111	53	149	1	1	2	5	0	6	3	1	1	1	1	0	0	0	1	0	2	1	0	2	2	3	1	0	0	1
17	1	4	17	102	44	149	1	1	2	4	0	3	3	1	1	1	0	0	0	0	0	0	1	2	0	2	2	3	0	1	0	1
18	1	4	16	106	55	158	0	1	2	5	0	6	3	1	1	1	0	0	0	0	1	0	3	2	0	1	2	3	3	1	0	1

19	0	4	18	107	63	148	1	2	2	4	0	3	1	1	1	1	0	0	0	0	1	0	4	3	0	2	2	3	0	1	0	1
20	1	4	16	101	55	150	1	1	2	5	0	6	3	1	1	1	0	0	0	0	1	0	1	2	1	2	2	3	2	1	0	0
21	0	4	17	108	45	148	1	1	3	5	0	4	1	1	1	1	0	0	0	0	1	0	4	2	1	2	2	3	0	0	0	0
22	1	4	11	84	39	143	1	1	1	5	0	7	3	1	1	1	1	0	0	0	1	0	1	2	1	2	2	3	2	1	0	0
23	0	5	11	86	49	152	0	1	2	5	0	5	3	1	3	2	1	0	0	0	1	1	1	2	1	2	2	3	0	1	0	0
24	1	4	15	101	45	147	0	2	2	5	0	4	1	1	1	1	0	0	0	0	1	0	3	3	1	2	2	3	2	1	0	0
25	0	4	18	106	50	145	1	1	4	3	0	4	1	1	1	1	0	0	0	0	1	0	3	2	0	3	2	3	0	1	0	0
26	0	4	11	89	55	149	1	2	3	4	0	6	3	1	1	1	0	0	0	0	1	0	1	2	1	3	2	1	2	1	0	0
27	0	4	12	89	51	152	1	2	2	4	0	5	3	1	1	1	0	0	0	0	1	0	3	2	1	3	2	1	1	1	0	1
28	1	4	11	89	45	151	0	1	2	3	0	4	1	0	1	1	1	0	0	0	0	0	1	2	1	2	2	3	0	1	0	1
29	0	4	11	85	47	146	1	1	3	5	0	7	3	1	1	2	0	0	0	0	1	0	4	2	1	2	2	1	0	0	0	0
30	0	4	11	88	45	150	1	2	5	5	0	5	3	1	1	1	0	0	0	0	0	0	1	2	1	3	2	1	3	1	0	0
31	1	4	10	75	46	148	1	2	2	4	0	4	1	1	1	1	0	0	0	0	1	0	2	2	1	2	2	1	0	1	0	0
32	0	4	13	94	52	149	1	5	3	2	0	4	1	0	1	1	0	0	0	0	1	0	1	3	1	3	2	1	2	1	0	0
33	0	5	15	93	48	152	1	2	2	5	0	6	3	1	1	1	0	1	0	0	1	0	1	2	1	3	2	1	0	1	0	0
34	0	4	18	102	46	145	1	2	2	4	0	5	3	1	1	1	0	0	0	0	1	0	3	2	1	2	2	3	2	0	0	0
35	0	4	17	99	52	148	1	3	3	5	0	4	1	1	1	1	1	0	0	0	1	1	3	1	1	2	2	3	0	0	0	0
36	1	4	9	82	51	153	1	2	2	5	0	7	3	1	1	1	0	0	0	0	1	0	2	2	0	2	3	1	2	0	0	1
37	1	5	9	76	52	151	1	1	3	4	0	4	1	1	1	1	0	0	0	0	1	0	1	2	1	2	2	1	2	0	0	1
38	0	4	13	93	48	150	0	2	2	5	0	6	3	1	1	1	0	0	0	0	1	0	1	1	1	2	2	3	0	1	0	0
39	1	4	14	93	50	148	1	1	2	5	0	5	3	1	1	1	0	0	0	0	0	0	1	2	1	2	2	3	0	0	0	0
40	1	5	14	98	45	147	0	1	3	4	0	3	1	1	1	1	0	0	0	0	1	0	3	2	1	2	2	3	2	0	0	0
41	0	4	16	90	50	148	1	1	2	5	0	6	3	1	1	1	0	0	0	0	1	0	1	2	1	2	2	3	0	0	0	0
42	1	5	14	86	46	145	1	2	3	3	0	4	1	1	1	1	0	0	0	0	1	0	1	2	1	3	2	1	0	1	0	0
43	0	4	15	96	46	148	1	3	5	1	0	4	1	0	1	1	0	0	0	0	0	0	1	2	0	3	1	1	1	1	0	0
44	1	4	15	102	46	145	1	2	2	5	0	6	3	1	1	1	1	0	0	0	0	1	3	2	0	2	2	3	2	1	0	0
45	0	5	14	88	54	143	1	2	4	2	0	4	1	1	1	1	0	0	0	0	1	0	2	2	0	3	2	1	0	1	0	1
46	0	5	13	91	45	149	1	5	5	1	0	3	1	1	1	1	0	0	0	0	0	0	3	2	0	3	1	1	0	1	0	0

47	0	5	16	98	46	139	1	1	2	5	0	6	3	1	3	2	1	0	0	0	1	0	1	2	0	2	2	3	0	1	0	1
48	1	5	15	97	48	152	1	2	3	4	0	6	3	1	1	1	0	0	0	0	0	0	1	2	0	2	2	1	0	0	0	0
49	1	5	13	85	58	151	0	2	2	4	0	4	1	1	1	1	0	0	0	0	1	0	1	2	0	2	2	3	3	1	0	1
50	1	5	15	90	50	146	0	1	2	5	0	4	1	0	1	1	0	0	0	0	1	0	2	2	0	2	2	3	1	1	0	0
51	0	5	14	82	54	151	1	2	2	5	0	5	1	1	3	2	0	1	0	0	1	0	2	1	0	2	2	3	2	1	0	1
52	0	5	15	103	49	144	1	2	3	4	0	3	1	1	1	1	0	0	0	0	0	0	2	2	1	2	2	3	0	1	0	0
53	0	5	13	97	49	147	1	1	2	5	0	6	3	1	1	1	0	0	0	0	1	0	1	2	1	2	2	3	0	1	0	0
54	0	5	14	101	45	150	1	2	2	5	0	5	1	1	3	1	0	1	0	0	1	0	1	1	1	2	2	3	2	0	0	0
55	1	5	18	100	45	149	1	2	3	3	0	4	1	1	1	1	0	0	0	0	0	0	1	1	1	2	2	3	0	0	0	0
56	0	5	13	90	44	147	1	1	2	4	0	5	3	1	1	1	1	0	0	0	1	0	2	2	1	2	2	3	0	0	0	1
57	0	5	15	97	38	145	1	1	3	3	0	3	1	1	1	1	0	0	1	0	1	0	2	2	1	2	2	3	1	1	1	0
58	0	5	15	91	55	152	1	1	2	4	0	4	1	0	1	1	0	0	0	0	0	0	1	1	0	3	2	1	0	0	0	0
59	1	5	15	99	56	152	1	1	2	5	0	6	3	1	1	1	0	0	1	0	1	0	1	2	0	2	2	3	0	0	0	1
60	1	5	14	95	52	157	1	2	3	3	0	3	1	0	1	1	0	0	1	0	0	0	2	2	0	3	2	1	0	0	0	1
61	1	5	14	95	39	143	1	1	3	3	0	5	3	1	1	1	0	0	1	0	1	0	1	1	0	3	2	1	2	0	0	1
62	0	5	19	103	39	145	1	2	4	3	0	4	1	1	1	1	0	0	0	0	0	0	2	2	0	2	2	3	1	1	0	1
63	1	5	18	110	53	152	1	1	2	4	0	5	3	1	1	1	0	1	0	0	1	0	1	2	0	2	2	3	0	1	0	1
64	1	5	16	106	45	148	1	1	2	4	0	3	1	1	1	1	0	0	0	0	1	0	2	2	1	2	2	3	0	1	0	1
65	1	5	15	103	49	150	1	2	2	3	0	4	1	0	1	1	0	0	0	0	0	0	1	2	0	2	2	3	2	1	0	1
66	0	5	15	103	45	153	1	1	2	3	0	3	1	0	1	1	0	0	1	0	0	0	2	2	0	3	2	3	0	1	0	1
67	1	5	15	103	50	145	1	2	2	5	0	5	3	1	1	1	0	0	0	0	0	0	1	2	0	2	2	3	0	1	0	1
68	1	5	16	103	50	151	1	2	2	4	0	4	1	1	1	1	0	0	0	0	1	0	2	2	0	2	2	3	1	1	0	1
69	0	5	10	84	35	145	2	3	5	2	0	5	3	1	1	1	0	0	1	0	0	0	1	1	0	3	2	1	0	1	0	0
70	1	5	11	89	46	153	1	1	1	4	0	4	1	1	3	2	0	0	0	0	1	0	1	2	1	2	2	3	2	0	0	0
71	1	5	13	98	44	157	0	2	2	4	0	5	3	1	1	1	0	0	1	1	1	0	1	3	1	2	2	3	3	1	0	0
72	1	5	16	101	54	149	1	1	2	4	0	3	1	1	1	1	1	0	0	0	1	0	1	2	0	2	2	3	0	1	0	1
73	0	5	18	100	51	153	1	2	3	4	0	4	1	1	1	1	0	0	1	0	1	0	2	2	0	2	2	1	0	0	0	1
74	1	4	17	107	43	149	1	2	3	4	0	5	1	1	1	2	0	0	0	0	1	0	2	2	1	3	2	1	2	0	0	1
75	1	5	16	104	43	152	1	2	1	4	0	5	3	1	1	1	0	0	0	0	1	0	3	2	0	3	2	3	2	1	0	1

76	0	5	11	88	35	143	1	1	1	5	0	4	3	1	3	1	1	0	0	1	1	0	1	1	1	1	2	3	1	1	0	0
77	1	2	12	91	41	147	1	1	2	5	0	5	3	1	1	1	0	0	0	0	1	0	3	2	0	3	2	3	2	1	0	0
78	1	3	7	68	41	151	1	2	1	5	0	6	3	1	1	1	1	0	0	1	1	0	1	2	1	3	2	3	1	1	0	0
79	0	1	10	83	47	163	1	1	2	5	0	5	3	1	3	1	0	0	0	0	1	1	1	1	1	3	2	3	0	1	0	0
80	1	3	11	76	45	147	1	1	1	4	0	3	1	0	1	1	0	0	0	0	0	0	1	2	1	3	2	3	0	1	0	1
81	1	3	12	89	44	151	0	2	2	5	0	4	1	1	1	1	0	0	1	0	1	0	1	2	0	2	2	3	1	0	0	0
82	0	1	7.5	67	47	148	0	2	3	4	0	3	1	1	1	1	0	0	0	0	1	1	1	1	1	3	2	3	1	0	0	1
83	1	3	11	86	45	147	1	4	4	3	0	4	1	0	1	1	0	0	1	0	0	0	1	1	1	3	2	3	2	0	1	1
84	1	3	13	97	42	148	0	1	1	4	0	5	2	1	1	1	0	0	1	0	1	0	2	2	0	3	2	3	1	0	0	0
85	1	2	15	97	41	149	0	4	2	5	0	4	3	1	1	2	1	0	0	0	1	0	1	1	1	3	2	3	0	0	0	0
86	0	4	15	96	37	144	0	2	1	5	0	3	1	1	1	1	0	0	0	0	1	0	1	1	1	3	2	3	1	0	0	0
87	0	2	15	93	52	158	1	2	1	5	0	5	1	1	1	1	0	1	0	0	1	0	1	1	0	3	2	3	0	0	0	1
88	1	5	17	102	39	145	1	2	1	5	0	5	1	1	1	1	0	0	0	0	0	0	1	1	0	3	2	3	0	0	0	1
89	1	3	14	95	37	139	1	5	3	2	0	8	2	0	1	1	0	0	0	0	0	0	1	1	0	3	2	1	3	0	0	1
90	0	2	15	99	42	147	1	2	2	4	0	5	3	1	1	1	0	0	1	0	0	0	1	1	0	2	2	3	2	1	0	1
91	0	1	16	97	51	153	0	4	3	4	0	5	3	1	1	1	1	0	0	0	0	0	1	1	0	3	2	3	2	1	0	1
92	1	1	20	110	55	157	1	2	1	5	0	7	3	1	3	2	0	1	1	0	1	1	1	1	0	3	3	3	2	0	0	1
93	1	2	19	103	43	153	0	3	4	4	0	6	3	1	1	1	0	0	0	0	0	0	2	2	0	3	2	3	3	0	0	1
94	0	2	14	98	41	151	0	4	3	5	0	5	3	1	1	1	1	0	1	0	0	0	1	2	1	3	2	3	3	0	0	1
95	1	2	14	99	39	151	0	5	3	4	0	5	3	1	1	1	0	0	0	0	0	0	1	1	0	3	2	3	2	0	0	1
96	0	1	16	109	50	145	1	2	1	4	0	5	3	1	1	1	0	0	0	0	1	1	2	1	0	2	2	3	0	1	0	1
97	1	4	18	105	51	152	0	2	2	5	0	5	3	1	1	1	0	0	0	0	1	0	1	1	0	2	2	3	0	1	0	1
98	0	3	17	109	46	146	0	2	2	5	0	4	1	1	1	1	0	0	0	0	1	0	1	3	0	2	2	3	2	1	0	1
99	1	4	15	106	42	146	0	2	3	2	0	9	2	1	1	1	0	0	1	1	1	0	1	2	1	2	2	3	0	1	0	1

100	0	3	16	106	52	148	0	1	2	5	0	3	1	0	1	1	0	0	1	0	1	0	2	2	0	2	2	3	0	1	0	1
101	0	4	11	85	46	153	0	1	1	5	0	4	1	1	3	1	0	0	0	0	1	0	2	1	1	2	2	3	0	1	0	0
102	1	5	4.5	53	40	145	0	2	1	5	0	5	3	1	3	1	0	0	0	0	1	0	2	2	1	2	2	3	1	1	0	1
103	1	3	10	93	52	156	1	1	1	5	0	4	1	1	1	1	0	0	1	0	1	0	1	2	0	2	2	3	0	1	0	0
104	1	4	11	80	43	148	0	2	1	5	0	5	3	1	1	1	0	0	0	0	1	0	1	2	1	2	2	3	2	1	0	0
105	1	2	15	93	43	149	0	1	2	5	0	10	2	1	1	2	0	0	0	1	1	0	1	1	0	2	2	3	0	1	0	1
106	0	3	14	108	51	156	1	1	2	5	0	4	1	1	1	1	0	0	1	1	1	0	2	2	1	2	2	3	0	1	0	1
107	1	2	15	110	45	150	0	1	2	4	0	6	3	1	1	1	0	0	0	0	1	0	2	2	0	2	2	3	0	1	0	1
108	1	3	10	83	43	148	1	3	2	4	0	3	1	1	1	1	0	0	0	0	0	0	1	1	1	2	2	3	0	1	0	0
109	1	3	5.5	68	37	144	1	1	1	4	0	4	1	1	1	1	0	0	1	0	1	0	2	2	1	2	2	3	0	1	0	0
110	0	5	11	92	48	142	0	1	1	5	0	5	1	1	1	1	0	1	0	0	1	0	1	2	1	2	2	3	0	1	0	0
111	1	1	11	90	41	145	0	2	1	5	0	4	1	1	1	1	0	0	1	0	1	1	1	1	1	2	3	3	0	1	0	0
112	1	3	11	88	46	154	1	1	1	5	0	6	3	1	1	1	0	0	0	0	0	0	1	1	1	2	2	3	0	1	0	0
113	0	5	12	95	46	150	1	2	2	5	0	6	3	0	1	1	0	0	0	0	0	0	1	1	1	2	3	3	0	1	0	0
114	0	4	13	94	55	145	0	1	1	5	0	4	1	1	1	1	0	0	0	0	1	0	1	2	0	2	2	3	1	1	0	1
115	0	3	14	91	59	147	1	1	1	5	1	6	3	1	1	1	0	0	1	0	1	0	2	2	1	2	2	3	3	1	0	0
116	1	4	11	86	49	144	1	3	2	3	0	3	1	0	1	1	0	0	0	0	0	0	1	2	1	2	2	3	0	1	0	0
117	0	4	15	110	48	140	0	1	1	5	0	7	3	1	1	1	1	0	0	1	1	0	1	2	1	2	2	3	2	1	0	0
118	0	3	14	92	53	158	0	1	1	5	0	5	1	1	3	2	0	0	0	1	1	0	1	1	0	2	2	3	1	1	0	1
119	1	4	13	91	52	151	1	3	2	3	0	3	1	0	1	1	0	0	0	0	0	0	2	2	0	3	2	3	0	1	0	1
120	1	2	15	94	41	149	1	3	3	4	0	4	1	1	1	1	0	0	1	0	0	0	2	3	0	2	2	3	0	1	0	1
121	0	2	12	103	44	152	0	1	1	5	0	6	3	1	3	1	0	1	1	0	1	0	2	1	1	1	2	3	1	1	0	1
122	1	3	12	102	51	155	1	2	2	3	0	3	1	0	1	1	0	0	1	0	1	0	2	2	1	2	2	3	0	1	0	1
123	0	3	6	63	55	149	0	1	1	5	0	5	3	1	1	1	1	0	0	1	1	0	1	4	1	2	2	3	3	1	0	1
124	1	5	7	71	48	142	1	3	2	4	0	4	1	1	1	1	0	0	1	0	0	0	2	3	1	2	2	3	0	1	0	0
125	1	5	9	91	36	157	1	2	2	4	0	4	1	1	1	1	0	0	0	0	0	0	2	2	1	2	2	3	0	1	0	0
126	0	1	9	85	33	142	0	1	1	5	0	5	3	1	3	1	1	0	0	1	1	1	1	1	1	2	2	3	2	1	1	0
127	0	1	11	93	39	147	1	1	1	5	0	6	3	1	1	1	0	0	0	1	1	1	1	1	1	2	3	3	1	1	0	0
128	1	3	7.5	82	41	141	1	2	2	2	0	4	1	0	1	1	0	0	0	0	0	0	1	2	1	2	2	3	0	1	0	0

129	0	2	7	79	31	148	1	1	1	2	0	3	1	0	1	1	0	0	1	0	0	0	3	2	1	3	2	3	0	1	1	0
130	1	1	8.5	76	37	148	0	1	2	4	0	5	3	1	1	1	0	0	1	1	1	1	2	1	1	2	2	3	1	1	0	0
131	1	3	9	88	45	153	1	2	2	4	0	4	1	1	1	1	0	0	0	0	0	0	1	2	1	2	2	3	0	1	0	0
132	0	3	7	68	40	159	0	1	1	5	0	5	3	1	1	1	0	0	1	1	1	0	1	2	1	1	2	3	2	1	0	0
133	0	4	11	100	40	148	1	1	1	5	0	6	3	1	3	1	1	1	0	0	1	0	1	2	1	2	2	3	1	1	0	0
134	1	2	9.5	82	45	153	1	3	2	4	0	4	1	0	1	1	0	0	0	0	1	0	1	2	1	3	2	3	0	1	0	0
135	1	4	12	92	41	148	0	1	1	5	0	6	3	1	3	1	1	0	1	1	1	0	1	2	1	1	2	3	3	1	0	0
136	0	4	14	92	37	145	0	1	1	4	0	4	1	1	1	1	0	0	1	0	1	0	1	2	1	2	2	3	0	1	0	0
137	1	3	11	75	41	148	1	2	3	2	0	3	1	0	1	1	0	0	1	0	0	0	2	3	1	2	2	3	0	1	0	0
138	1	4	8.5	76	39	150	0	1	1	5	0	5	3	1	1	1	0	0	0	0	1	0	1	1	1	1	2	3	1	1	0	0
139	0	1	12	89	51	146	1	2	3	2	0	3	1	0	1	1	0	0	1	0	0	0	1	1	1	2	2	3	0	1	1	0
140	0	1	9	75	56	151	1	2	2	5	0	4	1	1	1	1	0	0	1	0	1	0	1	1	1	2	2	3	0	1	0	0
141	1	4	4	50	42	145	0	1	1	5	0	7	2	1	3	1	0	0	1	1	1	0	2	2	1	1	2	3	3	1	0	0
142	1	3	6	61	41	149	1	3	2	4	0	4	1	1	1	1	0	0	1	0	0	0	2	3	1	2	2	3	0	1	0	0
143	1	3	6	62	52	148	1	2	2	4	0	5	3	1	1	1	0	0	1	0	0	0	3	2	1	2	2	3	0	1	0	1
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145	0	5	12	90	48	155	1	2	2	5	0	4	1	1	1	1	1	0	0	0	0	0	1	2	0	2	2	3	0	1	0	1
146	1	3	8	85	50	157	0	1	1	4	0	5	3	1	1	1	0	0	0	0	1	0	1	1	1	2	2	3	2	1	0	0
147	0	4	7	73	47	148	1	3	3	2	0	3	1	0	1	1	0	0	1	0	0	0	2	3	1	3	2	3	0	1	0	0
148	1	1	7	71	34	146	0	1	1	5	0	6	2	1	1	1	0	0	1	0	1	1	1	1	1	2	2	3	1	1	0	0
149	0	2	9	83	39	145	1	4	5	2	0	4	1	0	1	1	0	0	0	0	0	0	1	2	1	3	2	1	0	1	0	0
150	1	5	11	85	38	148	0	1	2	5	0	6	2	1	1	1	0	0	0	1	1	0	1	2	1	2	3	3	2	1	0	0
151	0	3	11	84	38	144	0	1	1	5	0	5	3	1	1	1	0	0	1	1	1	0	1	1	1	2	2	3	2	1	0	0
152	1	1	11	83	52	148	1	3	3	2	0	3	1	0	1	1	0	0	0	0	0	0	1	1	1	3	2	1	0	1	0	0
153	1	4	13	93	53	150	1	2	2	4	0	4	1	1	1	1	0	0	1	0	0	0	2	3	0	2	2	3	0	1	0	0
154	0	3	14	95	53	148	1	1	1	5	0	6	3	1	1	1	0	0	1	1	1	0	1	1	1	2	3	3	1	1	0	0
155	0	4	13	85	52	149	1	1	1	5	0	4	1	1	3	2	0	0	1	1	1	0	1	1	1	2	2	3	2	1	0	0
156	1	5	13	102	38	140	1	1	1	5	1	6	3	1	1	1	0	0	1	0	1	0	1	2	1	2	2	3	3	1	0	1
157	1	4	12	105	43	151	1	2	2	4	0	4	1	1	1	1	0	0	1	0	0	0	2	3	0	2	2	3	0	1	0	1

158	0	4	13	96	41	150	1	3	2	4	0	4	1	1	1	1	0	0	0	0	0	0	2	3	1	2	2	3	0	1	0	1
159	1	2	13	95	42	149	1	3	2	4	0	4	1	1	1	1	0	0	0	0	0	0	1	1	1	2	2	3	2	1	1	1
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161	1	5	9	75	51	155	0	1	1	5	0	6	3	1	1	1	1	0	1	1	1	0	1	2	1	2	2	3	2	1	0	0
162	0	2	11	88	45	152	1	2	3	3	0	4	1	0	1	1	0	0	1	0	0	0	2	4	1	2	2	3	0	1	0	1
163	1	5	10	84	37	153	0	2	1	4	0	5	3	1	1	1	0	0	0	0	1	0	2	2	1	2	2	3	2	1	0	0
164	1	3	6	69	36	154	1	2	2	4	0	4	1	1	1	1	0	0	1	0	0	0	1	2	0	2	2	3	0	1	1	0
165	0	4	10	89	38	154	0	1	1	5	0	5	3	1	1	1	0	0	0	0	1	0	1	4	1	2	2	3	1	0	0	0
166	0	3	8	80	35	141	1	3	2	3	0	3	1	0	1	1	0	0	0	0	0	0	2	4	1	3	2	1	0	0	0	0
167	1	4	13	97	35	141	0	2	2	4	0	4	1	1	1	1	0	0	0	0	1	0	1	1	1	2	2	3	2	0	0	0
168	1	4	11	93	41	149	1	3	2	3	0	4	1	0	1	1	0	0	0	0	0	0	3	4	1	3	2	1	0	0	0	0
169	1	2	12	98	41	154	0	1	1	5	0	5	3	1	1	2	0	0	0	1	1	0	2	2	1	2	2	3	1	0	0	0
170	0	2	11	85	35	145	1	2	2	5	0	4	1	1	1	1	1	0	1	1	1	0	1	1	1	2	2	3	0	0	0	0
171	1	3	11	82	39	150	1	1	1	5	0	5	3	1	1	2	1	0	1	1	1	0	1	2	1	2	2	3	2	0	1	0
172	0	2	8	80	35	150	1	2	2	5	0	4	1	1	1	1	0	0	1	0	1	0	1	1	1	2	2	3	1	0	1	0
173	0	3	11	92	41	151	2	3	5	2	0	3	1	1	1	1	0	0	1	0	0	0	1	4	1	3	2	1	0	0	0	0
174	1	4	7	69	35	142	1	1	1	5	0	5	3	1	1	2	0	0	1	1	1	0	1	3	1	2	2	3	0	0	0	1
175	0	2	7.5	69	42	148	1	1	1	5	0	4	1	1	1	1	0	0	1	0	1	0	1	2	1	2	2	3	2	0	0	0
176	1	5	7.5	70	37	149	1	2	3	2	0	3	1	0	1	1	0	0	1	0	0	0	2	4	1	3	2	1	0	0	0	0
177	1	2	10	86	36	149	1	1	1	4	0	5	3	1	1	1	1	0	1	0	1	0	2	2	1	2	2	3	2	0	1	1
178	0	5	11	91	40	146	2	3	2	5	0	4	1	1	1	1	0	0	1	1	1	0	1	2	1	2	2	3	3	0	0	1
179	0	4	12	101	39	146	0	1	1	4	1	8	2	1	1	1	0	0	1	0	1	0	2	2	1	2	2	3	0	0	0	1
180	1	4	12	92	38	148	1	2	2	3	0	3	1	1	1	1	0	0	1	0	0	0	3	4	1	3	2	1	0	0	0	1
181	1	2	13	95	36	146	1	1	1	5	0	5	3	1	3	2	1	0	1	1	1	0	1	2	1	2	2	3	2	0	0	0
182	0	4	10	87	39	150	1	2	3	4	0	4	1	0	1	1	0	0	1	0	0	0	4	4	1	2	2	3	0	0	1	0
183	1	3	9	81	38	145	0	1	2	5	0	4	3	1	1	1	0	0	1	0	0	0	2	2	1	2	2	3	2	0	0	0
184	0	5	13	98	34	146	2	3	3	3	0	4	1	0	1	1	0	0	1	0	0	0	1	2	1	3	2	1	0	0	0	0
185	1	3	11	85	41	152	2	5	5	1	0	3	1	0	1	1	0	0	1	0	0	0	4	4	1	3	2	1	0	0	0	0
186	0	2	9.5	83	45	153	0	1	1	5	0	6	3	1	1	1	0	0	1	1	1	0	1	2	1	2	3	3	2	0	0	0

187	0	3	13	100	51	149	1	3	4	5	0	4	1	0	1	1	0	0	1	0	0	0	1	2	1	3	2	1	0	0	0	0
188	1	2	14	102	41	148	1	2	2	5	0	5	3	1	1	1	0	0	1	0	1	0	2	2	1	2	2	3	0	0	1	1
189	1	3	11	81	41	152	0	1	1	5	0	4	1	1	1	2	1	0	1	1	0	0	2	2	1	2	2	3	3	0	1	1
190	1	5	12	95	35	145	1	2	2	4	0	5	3	1	1	1	0	0	0	0	1	0	1	2	1	2	2	3	2	0	0	0
191	0	2	13	95	36	146	0	3	3	4	0	3	1	1	1	1	0	0	1	1	1	0	1	2	1	2	2	3	0	0	1	1
192	1	3	11	89	36	145	1	2	2	4	0	5	3	1	1	1	0	0	0	0	0	0	4	4	1	2	2	1	2	0	0	0
193	0	4	12	92	36	148	1	1	1	5	0	6	3	1	1	1	0	0	1	1	1	0	3	2	1	2	2	3	0	0	0	0
194	0	4	9	80	35	145	2	2	2	5	0	4	1	1	1	2	1	0	1	0	0	0	1	2	1	1	2	3	0	0	0	0
195	1	3	12	85	42	149	1	1	1	4	0	5	3	1	1	1	0	1	1	0	1	0	1	2	1	2	2	3	2	0	0	0
196	1	3	10	70	39	145	1	2	2	5	0	4	1	1	1	1	0	0	1	1	0	0	2	2	1	2	2	3	2	0	0	0
197	0	2	9.5	76	51	146	1	4	5	1	0	3	1	0	1	1	0	0	1	0	0	0	4	4	1	3	2	1	0	0	1	0
198	1	3	9	74	51	145	1	1	1	4	0	8	2	1	1	1	0	0	0	1	1	0	1	3	1	2	2	3	3	0	0	0
199	1	2	12	91	44	131	1	3	2	5	0	5	3	1	1	1	1	0	1	0	1	0	1	2	1	2	2	3	0	0	1	0
200	0	2	9	79	39	144	0	2	2	4	0	6	3	1	1	1	0	0	1	1	1	0	1	2	1	2	2	3	2	0	0	0
201	0	3	9.5	77	38	148	0	1	1	4	1	3	1	1	3	1	1	0	1	0	1	0	2	2	1	2	2	3	1	0	0	0
202	0	1	14	104	42	150	1	2	2	4	0	4	1	1	1	1	0	0	0	0	1	0	1	1	1	3	2	3	0	1	0	1
203	1	1	13	79	45	155	1	1	2	4	0	5	3	1	1	1	0	0	1	0	1	1	1	1	1	2	2	3	2	0	1	0
204	1	1	11	84	46	152	1	3	5	2	0	4	1	0	1	1	0	0	1	0	1	0	2	1	1	3	2	1	0	0	0	0
205	1	1	12	78	41	150	1	2	2	2	0	5	3	1	1	1	0	0	1	0	1	0	1	1	1	2	2	3	0	1	1	0
206	0	1	11	88	45	156	1	1	1	5	0	4	1	1	1	1	1	0	1	0	1	1	1	1	1	2	3	3	2	1	0	0